PUBLIC WORKS

Devoted to the interests of the engineers and technical officials of the cities, counties and states

OCTOBER, 1938

A. PRESCOTT FOLWELL, Editor — VOL 69. NO. 10 — W. A. HARDENBERGH, Asso. Editor

Contents

TIMEWASTERS

Dora's Age:

Like most of the discussions regarding the age of the fair sex, this matter doesn't seem to be settled. Mr. Vinson points out that if Dora is now only 11 years and 4 months old, 5 years younger would be 6 years and 4 months, and that it has been 21 years plus since Dumb was 6 years old—too far back for Dora to be in the picture. Well, let's do the diplomatic and denote Dora's age simply as $-x$, which is the way most ladies' ages should be treated—with the accent on the *minus*.

Everyone seems to agree that there were 22 birds and 14 beasts in the zoo or menagerie. But it is something else again on the Ikey-Mikey problem.

Here are three answers from three high-grade mathematicians: Mr. Blunk says 4.71408 feet per second; Mr. Vinson says 7.071 feet per second; and Mr. Bevan says 6.27 feet per second. Tut, tut, gentlemen, differences no greater than that have caused wars in Europe. Let's have a conference to settle this matter. And, in the meantime—

Time Out:

The minute hand and the hour hand of a clock being 3 inches and 4 inches long, respectively, how far apart are the points of the hands at four o'clock?

James A. Vinson.

A Beer Putsch:

And this one from Johns-Manville again. We ought to charge them for the advertising, but this one is interesting and worthy of a little headscratching: During a parade the men in the procession marched 10 abreast. A marcher in the last row (rank, to be military) ducked into a tavern for a short beer. The grand marshal tried to reorganize the procession on the basis of 9 men to the row, since the street was too narrow for 11 to march abreast. But when he placed 9 men in each row he found that the last row came out with only 8 men in it, leaving one blank file, as before. Then he made a hurried attempt to form up with 8 men in each row; then with 7; then with 6; then with 5; then with 4; then with 3; then with 2; but the formation always came out with one vacant space in the rear rank. What was the least possible number of the men in the army?

To us there's no place like No. 2 in the rear rank, even if there is a blank file in it. *W. A. H.*

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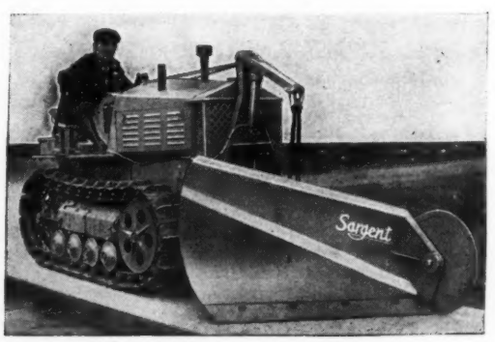

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PUBLIC WORKS Magazine . . OCTOBER, 1938

Vol. 69, No. 10

Snow Removal Practices Include Sidewalk Plowing

By DANIEL G. LACY

Supt., Highway Dept., Brookline, Mass.

BROOKLINE, Mass., is a community of approximately fifty thousand people. It has long since been recognized as a pioneer in the adoption and development of modern snow fighting equipment.

Before many municipalities had taken the work of snow removal seriously, Brookline had purchased a 10-ton crawler tractor and with the help of what would be considered today a rather awkward and cumbersome plow, succeeded in keeping open the roadway leading to its hospitals situated on steep hills. Today, with the automobile a necessity rather than a luxury, the department has extended the same high standard of service to practically all the thoroughfares.

Daniel G. Lacy, Supt. of Streets

Although it is not possible nor financially practical to anticipate every storm emergency, it is safe to say that Brookline is at the present time well equipped to meet every normal emergency, and has one of the finest equipped snow fighting divisions for a community of its size in the country.

The following is a list of the units reserved exclusively for snow fighting purposes:

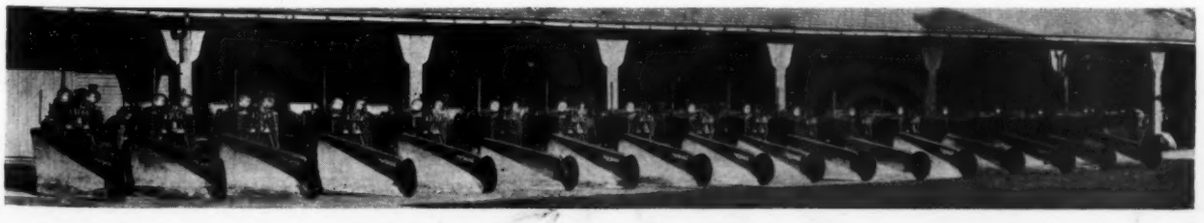
2—10-ton Caterpillar tractors.
1—10-ton Monarch tractor.
3— 7-ton Walters snow fighters.
24— 2-ton Cletrac sidewalk tractors.
1— 5-ton Allis-Chalmers tractor.
3—Barber-Greene snow loaders.
5—Sandsperters.
11—Blade plows.

The large crawler tractors are used in plowing roadways where the grade is exceptionally steep, or where, in the country section of the town, the stubborn resistance of a heavy drift is encountered.

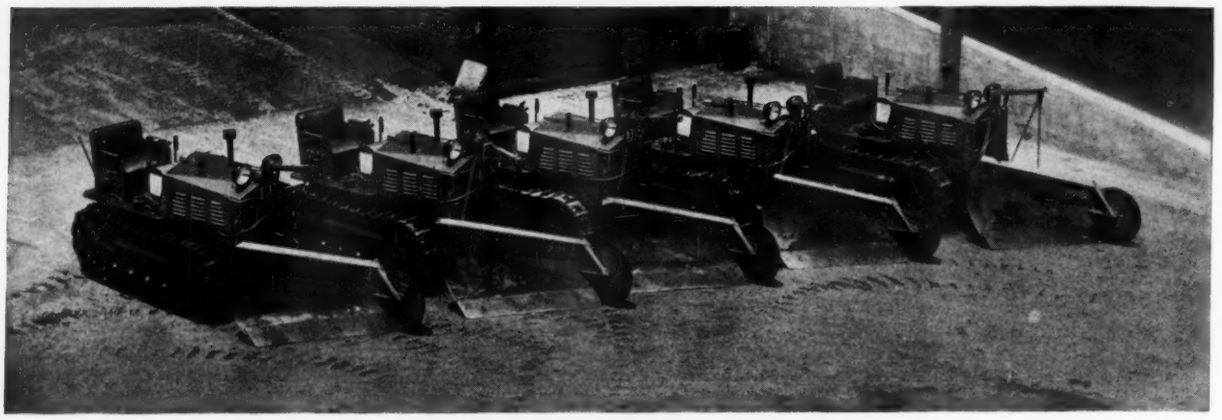
The Walters plows are used very effectively on principal thoroughfares, such as Beacon street, where, because of the width of the roadways and the improved type pavement, it is possible to plow snow at a speed of 35 to 40 miles per hour. These Walters units, furthermore, are equipped with a center blade which is controlled by hydraulic pressure, with the result that it is possible to plow improved type pavement extremely close to the road surface, so that with the slightest thaw or prevalence of sunshine for a very short period, the bare roadway is revealed to normal traffic.

The large heavy-duty tractors are supplemented by blade plows attached to contractors' trucks for use in the residential areas. At the beginning of each season, after the contract prices for road plowing have been established and the contracts awarded, the contractors bring their units to the equipment headquarters where the town's own plow attachments are affixed to these units. Then, during the progress of the season, as necessity requires, the contractor needs only report to the equipment headquarters where the blade plows are readily attached without delay.

It is interesting to note at this point that Brookline, which has been a pioneer in the work of snow removal,



Brookline's sidewalk plowers lined up for inspection.



Five of Brookline's 24 sidewalk tractor plows

has likewise led the way in the matter of mechanical plowing of sidewalks. A few years ago, this department conferred with some tractor manufacturers urging the construction of narrow-gauge crawler type tractors which would be suitable for sidewalk plowing, as the conventional type of tractors available on the market were too wide and too heavy to be suitable for this purpose. The engineers finally solved this problem and Brookline was the first community to take advantage of them when they were finally placed on the market.

Brookline is rather unique among other municipalities in the matter of snow removal from its sidewalks. Residents are not required to remove snow from the walks in front of their premises, the tax payers being willing to pay the cost of having this additional service performed by the municipality. When commuters, therefore, awake in the morning, they find that their sidewalks as well as their roadways have already been plowed.

Citizens seldom stop to reflect, however, on the planning that is required to meet these emergencies. The entire town has been laid out into various sections and routes. Each member of the supervisory staff of the department is assigned to some specific task, and every regular employee is given a definite route or post to cover. This planning, therefore, is done previous to the season of snow fall, and makes possible the speedy and efficient mobilization of the forces.

There are certain "key men" for each section and it is the duty of these men to call together those directly under them immediately upon notification from the highway "nerve center" at the equipment storage headquarters. If the storm is so severe that it requires instant mobilization, a special alarm is sent out by the fire signal system. The contractor's trucks report directly to the equipment headquarters, where the blade plows are attached, and as soon as two inches of snow have fallen the plows get under way and keep in progress with the storm so that it does not get beyond control.

Each man, as stated before, is given a post beforehand, and each successive storm finds him in the same position so that he becomes experienced and dependable within his own sphere.

It is interesting to note in passing, however, that throughout the storm every reaction of the elements has to be met. For example, snow precipitation may start with a light, dry, mealy type of snow which is difficult to plow because of the fact that it falls back into place after the plow has passed through it. Then again, there is a heavy, wet type of snow which offers considerable resistance to even the most powerful trucks and, should the temperature drop rapidly, this wet type of snow would become a solid mass of ice before the plows had completely covered the route. To enable the department superintendent to cope with this situation as far as possible, a constant check is made with the weather reporting agency.

Improvements are constantly being advanced in sidewalk tractors and before many years we may find some equipment available that will remove the snow from sidewalks more efficiently. Possibly an adaptation of the hydraulic pressure, similar to that used in road plowing, may be effected.

Another service offered by the town, which reflects itself in the task of removal, is that of carting away the snow in front of commercial establishments. As soon as the storm has subsided and the roadways and sidewalks have been cleared, the snow loaders are brought to the four shopping areas, where the snow is completely removed from in front of business establishments. In this way, roadways are widened and parking facilities are made available so that the merchants may conduct their businesses with a minimum of the loss which would result from inaccessibility.

In the more or less country sections of the town, snow fences are placed to prevent the heavy drifts of snow within the limits of the highway.

The regular force of the Highway Department is augmented during the winter months in the following manner: All men of twenty-one years of age who wish to be certified for employment during the snow storms are registered beginning the first of November. They are checked with the poll tax list to determine whether or not their poll tax has been paid and whether they are bonafide residents of the town. They are then given the registration cards, serially numbered with the instruction that they report to designated points in the town during snow storms. They are put to work in the order in which they report, until the number of workers required has been obtained.

A Barber-Green snow loader at work

Replacing An Active Water Main in Winter

By CHARLES BRODBECK
Superintendent of Water Dept., Decatur, Ind.

DURING my six years as a small plant operator my most interesting experience has been the removing of a four-inch cast iron main and replacing it with a six-inch, during the winter months of 1938. While the problems involved in this installation were numerous, there were three of importance. The first one was weather conditions. This being a WPA project, I had to keep the men busy, no laying off for bad weather.

Chas. Brodbeck

I started this job the early part of January this year, there being about 750 feet in brick pavement. As frost had penetrated to a depth of twelve to fourteen inches, I found it very difficult to raise the brick, almost impossible to remove a brick whole. After making a little progress on removing brick, a number of men were put to picking out the stone ballast. Even after getting through the stone bed, we had to continue to pick several inches in the dirt. This was slow and hard work. I finally tried scattering calcium chloride over the brick and dirt the width of the trench, hoping it would help pull the frost. That helped to some extent, but it was very slow. I next tried a 15-foot length of corrugated culvert tubing, laying in length-wise with the trench and building fire in it. After we really got started and some trench open, this last method of drawing the frost worked fast enough to keep three men busy raising brick and piling them along curb in order to keep ahead of pickers and spaders.

We finally got down to the main at point of beginning of 4-inch, with several lineal feet excavated, and ready to start removal of pipe. An acetylene torch was used to melt the lead out of the bells—it being bell and spigot pipe. It seemed almost impossible to burn the oakum out of the joints, and we found it no easy job to pull the free pipe out of the oakum, even though it seemed loose enough. Not being able to pull by hand and hand lines from bank of trench, we got chain falls and pulled from existing 6-inch pipe back of us. Even then a terrible strain was put on the chain falls to pull the loosened pipe out of hub. This method seemed to work fairly well but slowly, as only one joint at a time could be worked. During this time the weather was cold, the thermometer staying well below freezing and in the morning often near zero, and it was necessary to get the old pipe out and new pipe in and trench back-filled quickly to avoid freezing of main and service lines.

Universal pipe was used for the new line, but while it was laid easily and quickly the gang laying it was kept waiting on the crew removing the 4-inch. Realizing at once that something had to be done about that, I held up pipe laying until I had nearly a hundred feet uncovered, then employed a large dump truck (the city's coal truck), loaded it with coal as as to give it plenty of traction, and had the driver straddle the trench and chained the truck to about a hundred feet of pipe which had been melted loose at the back end. After two or three good pulls with the truck the loose joint let go and we pulled the whole string of pipe out of the trench in a few minutes, which would have required two or three days time using the method of removal we started with.

Thus I had only to wait for one joint to be melted out, and then had a nice string of pipe to lay immediately. The pipe pulled out were left laying in sections along the curb, and the other joints were melted out at our convenience, much faster and easier than in the bottom of the trench, which was always very wet and muddy, due to the draining the pipe each time we were ready to remove and replace.

The second problem confronting me was interruption of service while "cutting over" to the new 6-inch line. Several suspensions of service were necessary during the removal of 750 feet of pipe, but only for short durations. Those services remaining on the 4-inch line were not out more than twenty minutes at a time; as soon as a 4-inch joint was melted out and the line pulled apart, the bell was cleaned and plug inserted and the water turned on.

Of course, those services that were to be connected to the new 6-inch line were out of service a little longer, perhaps an hour to an hour and a half. I was able to hold this time down to a minimum because, before any "cut" was made, I measured the distance from every service to the end of 6-inch line and had the taps made (dry) in our shop. As the services were cut off from the 4-inch line, the corporations were removed and left hanging on the end of the service. The "taps" had all been measured off and "pipe marked" for that particular service. As I mentioned before, I used universal pipe on the job, and as it laid fast, I had my own plumber follow up, insert the old corporation and connect the service. Out of twenty or more services on this run of pipe, we only missed on one tap, which was drilled about three inches out of reach of the service. This unfortunately had to happen late in the afternoon. I went to the home of the consumer on this service and told him our difficulty. He said, "Don't let that worry you. I have a well here and can get along very well until morning."

The third question of importance was the freezing up of services left exposed before back-filling was accomplished. In order to resume service on the 6-inch line, it also had to be plugged. This plug was equipped with a one-inch vent controlled by a valve. If back-filling was not completed by the end of the day, I simply flooded the trench through the one-inch vent well above the service lines. While it was cold, I know it would not freeze that deep, although on several mornings there

was ice one to two inches thick. This procedure entailed some loss of water but at the same time utilized this water for flushing down the back-fill, and if there were too much water for flushing down the back-fill, it was pumped into catch basins and into sewers. This method of flooding was successful in preventing any frozen services.

Our method of back-filling was to water tamp, filling the trench to within a foot of the top, working from one end and pushing the water to the lower end where a 7000 g.p.h. Jaeger trench pump was used to pump the water out. A hose was connected to the discharge side of the pump, so that we could go back to the trench perhaps seventy-five to a hundred feet.

When the trench had settled, the old stone ballast was filled in and the remainder of the trench was filled in and smoothed off with screenings. There was very little after-settling of the trench when we were finished. The brick was relaid and slushed in with thin concrete about four months afterward, prior to the State Highway Commission resurfacing the street.

Cleaning Filter Beds With Sulphur Dioxide

By B. A. POOLE

Chief Engineer Indiana State Board of Health

DUE to magnesium encrustation which had raised the effective size of the sand in the North Vernon, Ind., filter beds from 0.4 m.m. to 0.55 m.m. within three years, the sand was treated with sulphur dioxide during the latter part of June. The treatment was in accordance with the procedure developed by J. G. Patrick, Chemical Engineer, West Virginia Pulp and Paper Company. This work, which is the first of its kind within the State of Indiana, was carried out under the supervision of representatives of the Bureau of Sanitary Engineering and a representative of the Industrial Chemical Sales Company.

In brief, the cleaning consisted of the application of sulphur dioxide to the underdrainage system of a filter which had been partially drained. The resulting sulfurous acid solution was then recirculated for eighteen hours.

The water in one filter was first drawn down to a point about six inches below the top of the sand, and the application of the sulphur dioxide was started. Sulphur dioxide gas soon started escaping through the sand in such proportions that the water level in the filter was raised to a point four inches above the sand level in order to minimize the escape of gas. After the addition of a sufficient amount of gas to produce approximately a 5 per cent solution of sulphurous acid, the recirculating pump was connected and put into operation.

After eighteen hours recirculation the filter was thoroughly washed and drawn down for observation. The top four inches of sand were quite clean but the next 3 inches of sand had a decided red color and had cemented together so tightly that it was necessary to break up this layer by the use of spades and rakes. The sand below this mat had been apparently untouched by the treatment.

The cause of the formation of this hard mat beneath the surface of the sand was not established, but it was assumed to be due to a foam formation on the water surface which was below the sand surface during the start of this treatment. Consequently, on subsequent applications the water level was maintained at least 3 inches above the sand surface at all times.

Believing the failure of the first application to be due entirely to the sand mat which had formed, sulphur dioxide was again added to the filter in sufficient amounts to produce a 2½ per cent solution of sulphurous acid. After 18 hours recirculation the filter was again washed and drawn down for observation. The sand was found to be quite clean in the area above the distributing manifold but was apparently untouched in other areas.

This fact indicated that the failure of the treatment might be due to a faulty underdrain system. Consequently, the sand and gravel were removed from one section of the filter, and it was found that the sand had found its way into the gravel bed and had accumulated around the laterals. The openings in the laterals were found to be corroded completely shut in many instances and further investigation revealed that the metal cover on the concrete manifold had become loosened, thus preventing any appreciable amount of pressure from reaching the laterals. This fact probably accounts for the failure of the sulphur dioxide to reach and clean the clogged orifices in the laterals.

The sand and gravel were then completely removed from the filter and regraded. The orifices in the laterals were opened and the manifold cover was sealed into place. After the sand and gravel had been replaced, sulphur dioxide was again added to the filter in sufficient quantities to produce a 5 per cent solution of sulphurous acid. After eighteen hours recirculation and a thorough washing of the filter, the sand was again observed. This third application was successful.

The second filter was then treated and results were successful upon the first application.

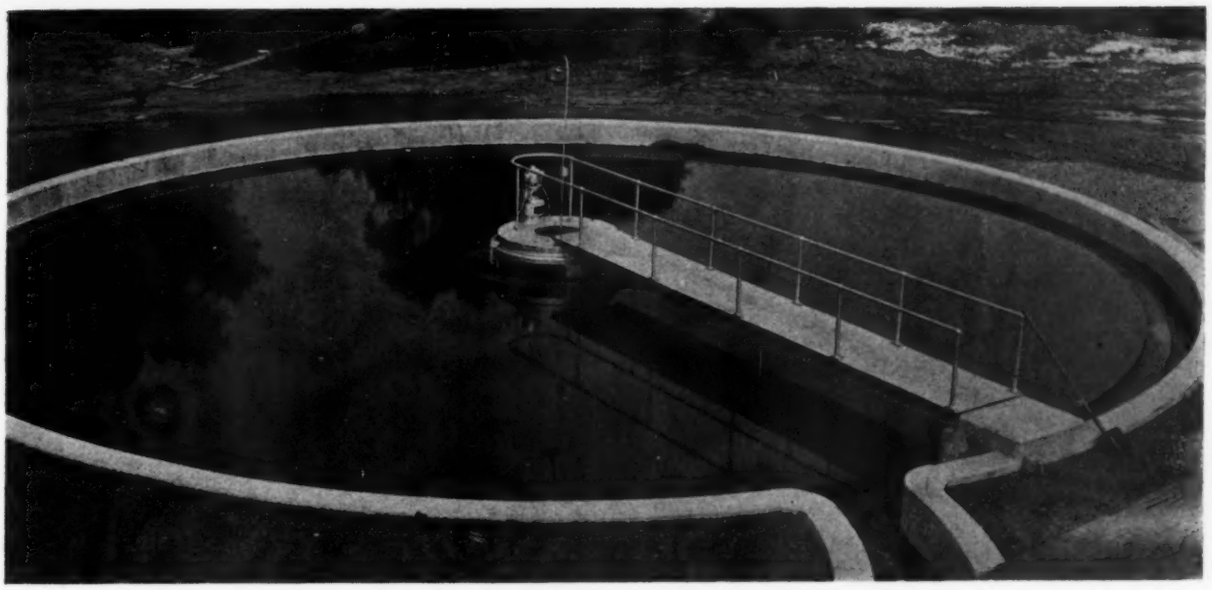
Pressure Losses in Pipe Bends

In even the simplest piping system, the pipes must change direction in many places. Therefore, bends, and particularly 90-degree bends, are perhaps the most frequently used fittings. As pressure losses in bends are greater than in the same lengths of straight pipe, the effect of a number of bends in a pipe line is to decrease the flow. To obtain a given flow, it is necessary to increase the pipe diameter or to provide more pumping capacity, either of which expedients increases the expense of the installation.

Many experiments have been made to find the exact pressure losses in pipe bends, but the results seem to be very inconsistent. A paper by K. Hilding Beij in the July *Journal of Research* (RP1110) describes an investigation which forms part of a general program under way at the National Hydraulic Laboratory, to determine the reasons for these inconsistencies, with the ultimate object of developing, if possible, reliable formulas for computing pressure losses in pipe bends.

The experiments concern 90-degree pipe bends in 4-inch pipe lines. Tests were made on bends varying from 6 to 80 inches in radius. It was found, for bends having a radius of four times the pipe diameter or less, that the results could be brought into agreement with those made by previous experimenters under comparable conditions, provided the roughness of the pipe walls was taken into account. More work was needed, however, to determine the exact relationships, and hence a working formula.

For bends of radius greater than four times the pipe diameter it was found that other unknown, and as yet unpredictable, effects obscure the problem. Until the problem is solved, the designer must use the experimental results which indicate the highest pressure loss in order to be certain that the pipe capacity will be sufficient.—Journal of Franklin Institute.



Clarifier No. 2 doesn't look like a part of a sewage treatment plant

A Year's Experience with Chemical Precipitation

By JOHN W. HOOD

Plant Engineer, Ridgewood, N. J.

The Ridgewood plant consists of a grit remover, comminutor, primary and secondary settling tanks, trickling filters, final settling tank, sludge digester and beds. With the clarifiers operating in series, the capacity is 1 to 1½ mgd.: operating in parallel, about twice as much. Aluminum sulphate is the coagulant. The first article appeared in the September issue.—Ed.

UNSATISFACTORY coagulation resulted during December, 1937, and January, 1938, and H_2S odors in raw sewage became so objectionable that a temporary shed, used as a pre-chlorination station during the summer months, was insulated and equipped with automatic electric heat; and the application of chlorine to the trunk line two miles above the plant was commenced. From 75 to 150 pounds of chlorine per day (8 to 16 ppm. based on an average flow of 1,100,000 m.g.d.) were applied. Even with this dosage, odor control was not complete, as the chlorine demand varied up to 25 to 35 ppm. at times. The raw sewage temperature range was from 34°F to 40°F during this period.

Since biological or bacterial reduction of sulphates normally progresses only at temperatures ranging from 60°F up, it was difficult to explain the origin of the hydrogen sulphide. A. E. Griffin, research chemical engineer of Wallace & Tiernan Company, attributed the H_2S evolution to a facultative type of anaerobic bacteria, reducing the sulphates present in the sewage. Various authors and authorities on bacteriology were found to be of the opinion that many species of sewage bacteria are capable of envolving H_2S; notably Fuller and McClintock, page 82, emphasize that bacteria of many forms are responsible rather than a particular form or species.

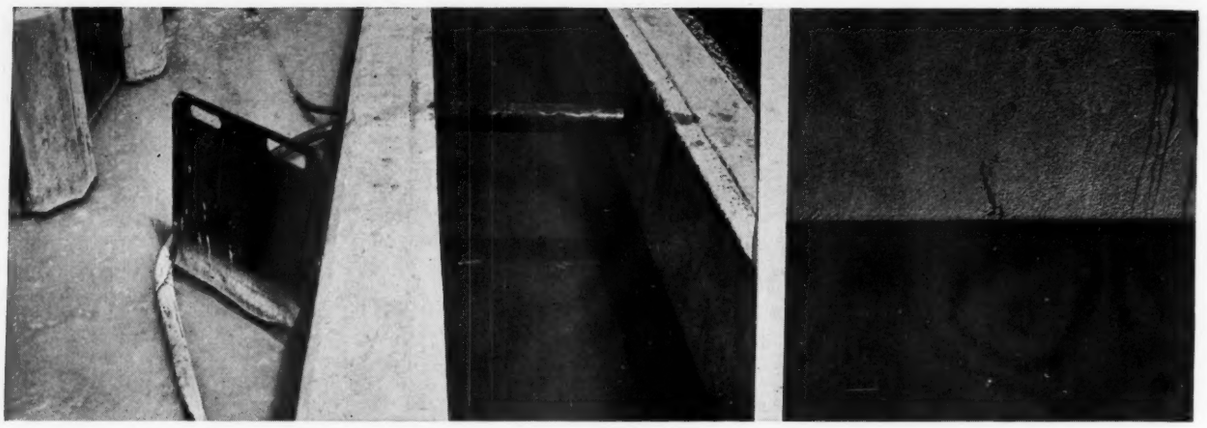
An inspection of the 50 miles of sewer lines in the village disclosed that nearly all the pipes were heavily furred with a gray algae, some lines being almost completely filled. Microscopical examination of samples of the algae taken from various sections of the sewage system disclosed a predominance of Beggiatoa; paramaecium was numerous and active within the algae or fungus structure; uroglena was also well represented. These being the major groups present, more especially the "Beggiatoa" which seemed to be the parent structure, no further examination was made for other types.

Five out of six references found were of the opinion that Beggiatoa were true sulphur bacteria, and did not reduce sulphate; the sixth reference, *Bergey's Manual of Determinate Bacteriology,* stated that Beggiatoa was capable of reducing sulphates and secreting the amorphous sulphur within their cells. Due to the preponderance of Beggiatoa, it was felt that the sixth reference was in this particular instance the correct one.

Through the courtesy of Wallace & Tiernan, additional experimental chlorine machines were made available and heavy doses of chlorine were applied to various points in the system. After one week, this work was discontinued since it was apparent that the fungus was not being dislodged from the sewers.

Reference to the Nichols Copper Company publication by Dr. Frank E. Hale disclosed that 5 ppm. of $CuSO_4$ were necessary to destroy Beggiatoa, and a supply of copper sulphate was obtained and work begun on its application to the sewers and plant structures.

Small amounts were placed in each flush tank and terminal manhole and also at intermediate intersection manholes where it was observed that fungus was growing profusely; 700 lbs. of $CuSO_4$ were thus distributed in the system over a period of several days and upon com-



Extreme left, raw sewage; center, the effluent channel showing a shoe horn, through 10 ins. of sewage; right, the shoe horn again. The effluent is uniformly of surprising quality

pletion of this work the flushing of sewers was commenced. In some lines the pipes were literally full of dislodged fungus, which the flushing brought down, but both chemical precipitation (using aluminum sulphate) and sludge digestion proceeded without interruption.

Since the copper sulphate treatment, there has been a marked reduction in cholorine demand. This past summer, with the raw sewage temperature ranging from 64 to 70° F, the daily dose of chlorine for full odor control has ranged from 0 to 18 lbs. (0 up to 2 ppm.) with a daily cost of $1, whereas a year ago the cost averaged $6 to $8 per day. Two chlorinators have been used for application; one, situated on the trunk line two miles upstream from the plant, is set at 10 lbs. per 24 hours when in operation; and an experimental panel chlorinator, loaned by Wallace & Tiernan, is located at the plant and used only at low flow periods, when lengthened detention in the plant units tends to develop odors.

Recently, an increase in chlorine consumption was noted at the plant. A sewer survey indicated that some of the lines were again growing fungus and 150 lbs. of $CuSO_4$ were distributed in these lines. On August 12 and August 13 the chlorine consumption necessary to control odors at the plant dropped from 14 lbs. required previously to 5 lbs. and on August 14 to 3 lbs.

Laying the twin cast iron lines to the plant

Based on the knowledge derived from the acid-alum procedure work, it was decided to plot the determinations of pH, alkalinity and CO_2 on composite graphs to show their respective trends in relation to one another and also for the purpose of ascertaining which constituent, if any, paralleled the coagulant demand. These graphs showed that the bicarbonate alkalinity curve parallels the known coagulation demand, that it reaches its zenith at the hour of greatest coagulation difficulties and that its high range coincides with the well known and often troublesome hours of 10 AM to 2 PM. These determinations were made hourly from 8 AM to 5 PM on November 29, 1937, when good results were being obtained in the plant scale chemical treatment.

Since wash days with their added burden of alkalies usually prove to be the most difficult for any type of treatment, hourly pH, alkalinity and CO_2 determinations were run for a wash-day—Aug. 15, 1938—and also for Thursday, Aug 18, 1938, a normal week day, and curves plotted from them. A study of these curves will demonstrate their probable significance as factors in the operation of a chemical treatment process. When determinations are run on the treated effluent, it will be found that crystal, clear, and cloudy samples will sort themselves out into more or less well defined zones. In other words, residual pH and alkalinity appear to determine effluent turbidities, and a line of demarcation possibly may be established for each plant, below which excellent results are assured and above which clarification will be incomplete and turbidities high.

On July 20, 1938, with a crystal clear effluent being obtained during the entire 24 hours, it was decided to take a "picture" of the sewage on its way through the plant, in respect to pH, bicarbonate alkalinity, and free CO_2*

How Flow Through the Plant Affects Sewage

	Alkalinity	*pH*	*CO_2*
Raw Sewage	150	7.0	38
Clar. 1. Effl.	140	6.4	48
Clar. 2 Effl.	118	6.25	74
Filter Effl.	70	6.75	20

The peak free CO_2 content was 74 ppm, but as high as 94 ppm have been determined after the alum-post acidulation procedure. There is no evidence in this work, that excessive amounts of CO_2 are a factor in producing an unstable floc; in fact, indications are definitely that it has no effect, and that it is excessive alkalinity that

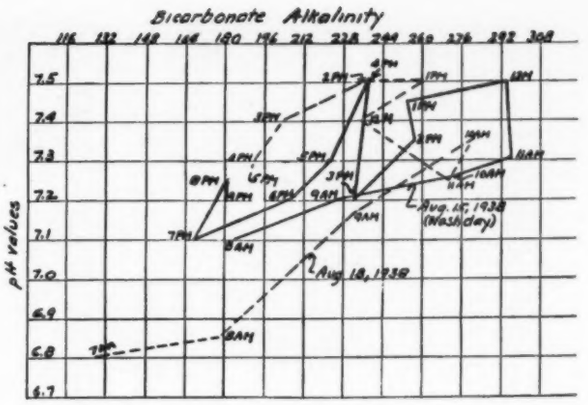
* The procedure in Standard Methods was used in making this test.

prevents formation of a floc that will setttle to produce a clear and satisfactory effluent.

With respect to CO_2 reduction by the trickling filters, considerable difficulty is experienced in keeping the dosing tanks free from algae growths, but it has been observed that the outfall channel from the trickling filters does not offend in this way. However, when the clear effluent from the chemical treatment is passed direct to the outfall channel without aeration through the filter nozzles, algae growths are prolific in its gravel bed. Dr. Charles O. Chambers, in a report of the Missouri Botanical Gardens, Dec. 18, 1912, stated "There is an intimate and mutual relation between the algae and submerged aquatics in a body of water and the gases dissolved in that water. They fluctuate together."

A feature of this plant has been the unusually large amount of gas produced by the digester. From June 6 to June 30,1938, the production was 542,000 cu. ft. Over a long period of time, the average has been more than 16,000 cu. ft. per day, and not all of the gas is collected, since the old digester at the plant, not equipped for gas collection, is used to provide 2-stage digestion.

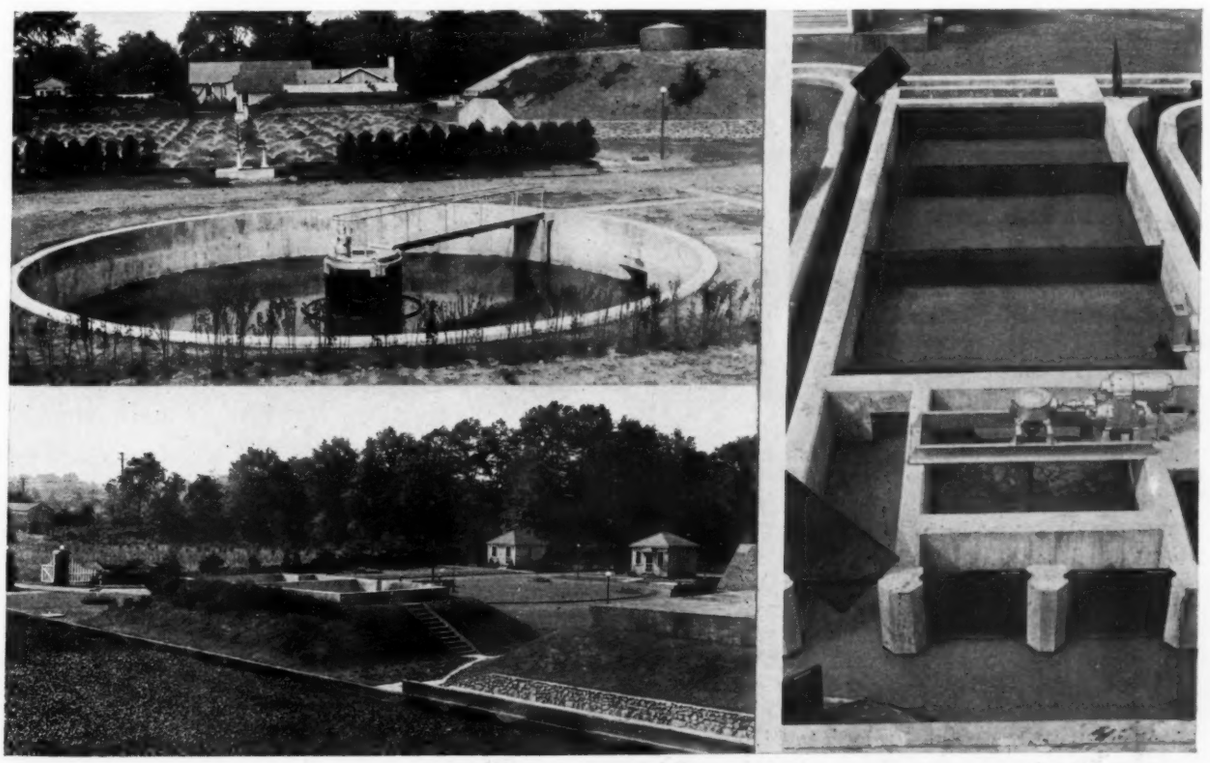
The Ridgewood plant is equipped with an automatic volumetric control for the proportioning of the aluminum sulphate. This control consists of a Builders Iron Foundry Chronoflo which records the flow and, at the same time, transmits signals to a Wallace & Tiernan dry feed machine, the length of which signals are in direct proportion to the rate of flow. Through the medium of relays, these signals are converted to "on and off" operation of the feeder on a 60-second cycle basis. Considerable savings in chemicals and labor, and improvement in results have accrued from this installation. It is still necessary, however, to control manually the concentration of the doses, based on the frequent observation of plant results.



Hourly pH and alkalinity variations, for two representative days

The writer is indebted to the following for their valused assistance and cooperation in making microscopical examinations and loaning references: Mrs. Horning, bacteriologist, Wallace & Tiernan Co., Belleville, N. J.; Miss Wholey, bacteriologist, Muster & Baumann, Ridgewood, N. J.; Paul Tamer, Chemist & Biologist, Hackensack Water Co.; Richard C. Smith, Chemist in Charge, Passaic Valley Sewage Commission.

References utilized in this work include: *Microscopy of Drinking Water,* Whipple; *Water Purification,* Ellms; *Water Supply Control,* Cox; *Sewage Disposal,* Geo. A. Fuller; *Bergey's Manual of Determinate Bacteriology,* Williams and Wilkins; *Application of Electro Chemistry,* W. A. Koehler; *Application and Uses of Copper Sulphate,* Frank E. Hale; *Water Works Handbook,* Flynn, Weston & Bogert; *Solving Sewage Problems,* Fuller & McClintock: *Standard Methods of Water Analysis.*



The two views at the left show the Ridgewood plant. Above are the final settling tank and the trickling filters, with buildings in background. Below, left, the plaza; at the right flash mixer and flocculator

Light four - wheel - drive truck equipped with one-way plow, used at beginning of snow storm.

Summer

EACH of the seventy-one counties in Wisconsin is responsible for open highways during the winter months on all state and county highways within its jurisdiction. Many of the counties in Wisconsin also handle much of the work of snow removal for the townships, although the amount of snow removal work done by the counties on town roads depends, in most counties, on the arrangement that the individual township makes with the county. The Wisconsin State Highway Department does not own snow removal equipment; it depends entirely on equipment owned by counties, or in a few cases on contractors, for all work done on state roads. A detailed schedule of rentals for use of county-owned equipment used on state highways has been established by the State Highway Department, and the rentals allowed by the state for the use of equipment form the basis of accounting for most work done on county and township roads throughout the state.

Waupaca County is one of the very few counties in the state in which the option of snow removal is not left to the individual townships. The County Board appropriates $40,000 each year for snow removal and ice control on county trunk and township roads, which is in addition to the rentals allowed by the state for winter maintenance on state highways. We have to keep open during the winter the 164 miles of state highways in our county and 1,040 miles of township roads as well as 220 miles of county trunk highways. Our snow removal costs vary from $25,000 to $40,000 per season, depending upon the amount of snowfall, drifting, and ice conditions.

Equipment

Our snow removal equipment consists of 4 tractors, 21 four-wheel-drive trucks, 5 rear-drive trucks, and 4 motor patrols. The motor patrols are only used in cutting ice on pavements. Our tractors—three large Caterpillar Model RD8 and a smaller Caterpillar Model RD6—are all equipped with V-type snow plows with full hydraulic control. Our four-wheel-drive trucks range from 2 tons to 10 tons capacity, the majority, however, being the 7½-ton M7 Model FWD trucks, four of which are equipped with Diesel engines. All of the four-wheel-drive trucks are equipped with full hydraulic V-type snow plows, except the 2-ton FWD's which are equipped with one-way plows. The rear-drive trucks used in this work are GMC's of 2-ton capacity. The motor patrols are Caterpillar No. 11.

In both our construction and maintenance work on all state and county roads (we do not have jurisdiction over township roads) we try to eliminate as many obstructions as possible that might cause drifting. On all new road construction, we insist that all stones be buried or hauled away, and that other obstructions be removed whenever practical. This year we have a WPA project on roadside clearance, and they are removing

Waupaca County highway offices and main repair shop; 80' x 110' with 18' overhead clearance

many of the obstructions that have caused drifting, which were overlooked in previous years when constructing the roads. Our grades also have been raised during the past few years, so that in many places the snow blows off the road even in the worst blizzards.

In the fall of the year, we have our motor and truck patrol men supervise the erection of snow fences in their district. Our county is divided into twenty patrol districts, so that each patrol man has an intimate knowledge of the locations where drifting occurs in his district. It is gratifying to note the interest these patrol men take in watching their recommendations for the proper placing of the snow fences, and the effectiveness of their recommendations for placing the snow fences allotted each district. We have about fifty miles of snow fence and purchase about five miles of additional fence each year. We also encourage the townships to buy snow fence. During the past year, every township in the county joined in this drift prevention plan by adding at least one-half mile of snow fence for their worst drifting locations. The townships plan to add to their snow fence each year. Our experience has shown that snow fences reduce the cost of snow removal about one-third, which makes it a profitable investment in drift prevention.

All of our snow fence is stored in three central locations, practically all under cover. Before the snow fence is set out, it is repaired, and then dipped into a paint

Roads All Winter

Charles W. Larson

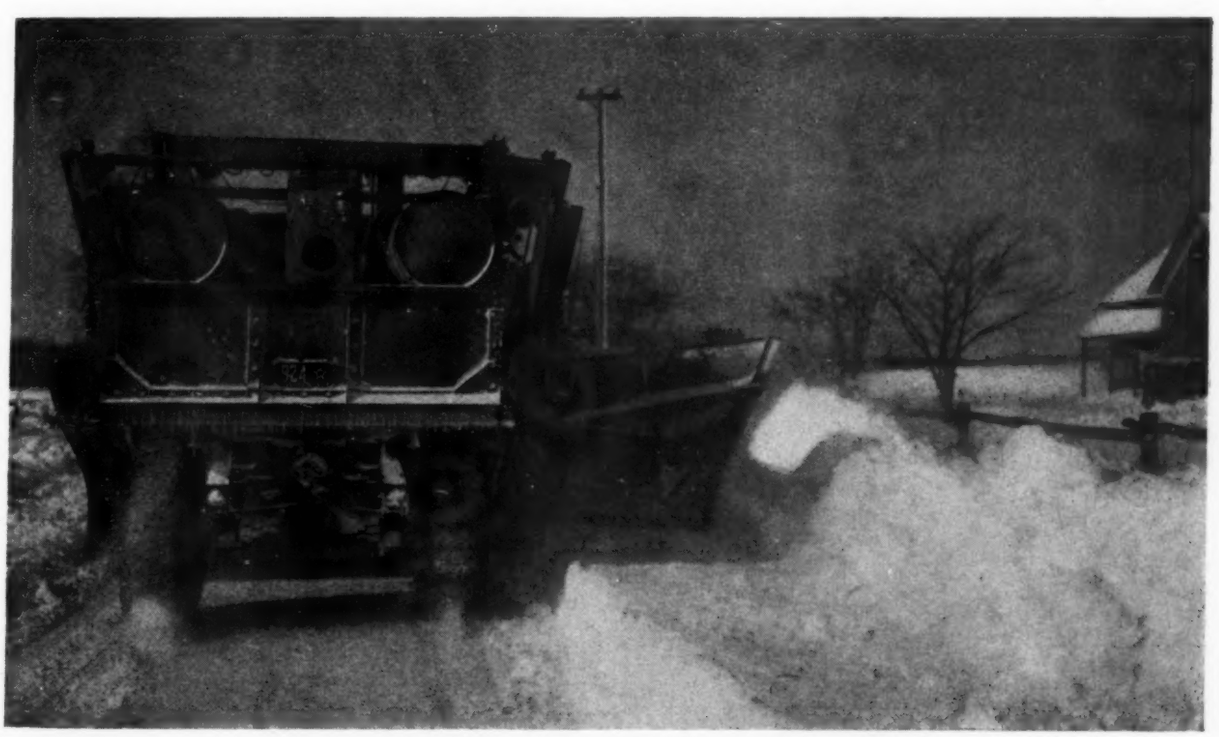
By CHARLES W. LARSON
County Highway Commissioner, Waupaca County, Wisconsin

tank, which increases its useful life many years. It is real economy to haul the snow fence to the three central locations and keep it out of the weather, and then repair and repaint before setting the snow fence out in the fall. We formerly piled the snow fence along the right-of-way as close as possible to the location where the fence was used, and provided stands to keep it off the ground. Each year, however, we experienced losses which now are entirely eliminated by hauling the fence to the three central locations.

Along with the erection of snow fence, which is carried on after the roads freeze up, we get busy on our stock piles for ice and sleet sanding. Each patrol section has its stock pile for sanding, mixing up about 1,000 yards of sand with calcium chloride, in the proportion of about fifty pounds of calcium chloride to one yard of sand. We also have a central stock pile at the county highway shops in case any of the patrol divisions should run short.

The motorized equipment and snow plows are all brought into our central repair shops in plenty of time for a thorough checkup before the snow flies. While our head mechanic gives each piece of equipment a thorough inspection and check up in recommending the extent of work to be done on the equipment, he relies largely upon the driver's recommendation for bringing the equipment to as near perfect condition as practical for the hard work ahead. The same truck and tractor drivers that are used in the summer months are used in the winter months; in fact, we plan our work so as to have continuous employment for our employees, and only in emergencies and for special work do we hire extra help. We have from 110 to 115 men on our regular payroll the year around.

We find that our motor patrol men make good truck and tractor drivers and helpers, and these men are detailed in helping to get the equipment in condition for the winter's work. All trucks are equipped with hot water heaters, defrosters, the cabs checked for carbon monoxide gas, and new cushions installed. Each truck is equipped with plenty of flares, a good set of tools and flash lights. We also installed auxiliary gas and



Auxiliary fuel and oil drums mounted in body for 24-hour operation

oil tanks, so that each unit carries sufficient fuel for twenty-four hours of continuous operation. We pay special attention to making the driver's compartment in our snow removal equipment as comfortable as possible, for at best, snow removal is strenuous work.

All of our snow plows, including their wings, are hydraulically controlled, requiring only the manipulation of a valve to regulate the main plows or wings. Experience has shown us that it is expecting too much to ask a man to stand out in the cold winter weather and operate manually controlled wings, especially at night in a raging blizzard. It is only natural that the men will not use the snow plow wings as effectively, and in addition, high-speed truck units are slowed down at least 50% when not equipped with hydraulic or power-operated wings.

During a heavy snow storm the men take advantage of our modern dormitories at the highway garage, by sleeping there between shifts. We can accommodate twenty-five men, and the dormitories are provided with shower baths and other comforts of a home. Our snow removal crews work on two 12-hour shifts, one shift starting at noon and working until midnight, and the next shift from midnight until noon. Night operations are, of course, much harder work than the same work during the day time, and with this schedule each shift shares a portion of the difficult hours. Each man carries his dinner and is expected to keep on the job continuously for the duration of his shift, if the work of keeping the roads open is urgent.

While the greater share of our equipment is held in readiness for snow removal service at our main repair shops, which are so located that the farthest point in the county is only thirty miles distant, we also keep equipment in two additional points for quick service.

When a snow storm starts and sufficient snow has fallen or drifted to slow up traffic, our patrol superintendent gets out the light rear drive and light four-wheel drive equipment with one-way plows on the job. These trucks are operated at high speed from twenty to thirty-five miles per hour, and they throw the snow as far off the road as possible. When the roads get so that these trucks can no longer operate at high speed due to the storm, we call out the heavy-duty four-wheel-drive trucks with V-plows and wings and we attempt to keep at least a single lane open at all times on the state and county highways. In the worst storm in recent years, only one of our state highways was closed as long as two hours. Should the occasion arise that it would appear that the storm was gaining on us, we would put all our equipment on the state highways to keep them open, but so far our worst storms in recent years have not made this necessary. Our first concern is to keep the state highways open, then the county roads, and the township roads last.

High-speed snow removal reduces the cost of winter maintenance

We seldom use our tractors on either our state or county highways, as our 125 to 200 horsepower FWD's have more traction on the concrete highways, and the tractor lugs are apt to damage the bituminous or oil roads. We also find the four-wheel-drive trucks are far more economical as they can cover so much more road in the same length of time. Our worst snow removal conditions are on our township roads; and the tractors are used on those township roads that are so narrow and rough that the faster speeds of the four-wheel-drives can not be safely used. One can easily break up more equipment on one mile of township road than in a month's plowing on a state or county highway in the same depth of snow, due to hidden obstructions and the hazards of slipping off the road. The slow speed of the tractor is particularly effective in these conditions. The townships are gradually eliminating many of their narrow roads, as they recognize the delay necessary in plowing them when the tractors are used. We are, of course, anxious to get the township roads open just as soon as possible, as the farmers in this county major in dairying, and fresh milk can not be stored for more than a day or two, even in the winter months. In our worst snow storm in recent years, we had all of the township roads open within three days, although in an average winter they are usually not closed for more than a day after a storm.

The supervision of the snow removal crews is handled by our patrol superintendent and his assistants at the central shops. The driver of each piece of equipment telephones the central shop when he turns his equipment over to the driver of the next shift, reporting what roads are cleared; and, on the same call, the new driver is given his routing for the next twelve hours. The progress of the snow removal crews is traced on a control map at the central highway office, so that no roads are overlooked. We keep three or four men at the central shops day and night to answer calls from the truck and tractor drivers. We use a 4-ton FWD with a platform body and winch for towing or hauling any equipment that fails to work or slips off the road.

Gas and oil are delivered to each piece of equipment on the job each twenty-four hours. We use a 2-ton FWD for this work, which is equipped with an 800 gallon tank. We buy our gasoline and oil in the open market in carload lots, and save from three to four cents a gallon as compared with purchasing it at retail. Our snow removal equipment will burn up from 1,500 to 3,000 gallons a day, so the fuel truck is a distinct economy.

As soon as the storm abates, we swing into widening and moving the snow banks back as far as possible. We use an extra special long wing on our 200 horsepower 10-ton FWD for shoving the banks back and use the lighter equipment with one-way and V-plows in cleaning up. When the snow gets piled high, we find a shelf made near the top of the banks, which is made by shoving the top of the bank back, makes an effective stopper for whatever snow might drift directly into the road, were it not for this shelf.

Our sanding operations are handled by the patrol men in each patrol section, with helpers working on twelve-hour shifts if necessary. We hope to have sanders for each of our light trucks in each patrol division this winter, as we find this work can be speeded up just

(Please turn to page 36)

The Editor's Page

State Highways Pay 13½% Dividend in 1937

Out of every dollar of state taxes paid by highway users in 1937, 13½ cents were diverted to other uses. That is, the highway systems of the states paid a dividend of 13½% to the people of the state, in addition to the construction of new roads, maintenance, etc. Bond issues of about 65 million dollars might be subtracted from this dividend, but since these will be used to construct revenue-producing properties, it is not accurate to do so. Instead this cost should be amortized over the period of years that these new highways will serve. In addition, about 75 millions of obligations were retired.

In 1936 the dividend paid by highways amounted to 16%, or somewhat more than that available in 1937.

The convenience, aid to business and pleasure, and other values accruing from a highway system are not considered in the returns from this billion dollar business. While we are very much opposed to diversion for reasons too numerous to be listed here, it is good to know that our highway investment is a sound one, capable not only of paying its own way, but also of returning a dividend to help in other needed work.

Health Workers With Non-Medical Training

Modern health work covers a wide range of activities and requires the cooperation of engineers, chemists, bacteriologists, dairy and milk control experts, nurses, and many others.

Just now the old controversy between those with medical training and those without appears to be coming to a head, and the matter will come up before the American Public Health Association at the meeting late this month in Kansas City.

Doctors, seeing their predominance in a field which they claim for their own slipping away with the advent of the new public health, are making a strong effort to keep for themselves the direction of all health work, holding all other professions to purely secondary ranks. Their stand is similar to that which they took a few years ago in claiming that they alone should have charge of garbage collection and disposal; and little progress was made in that municipal service until it was taken out of their hands.

Engineers and sanitarians, to our mind, appear to be especially fitted for solving problems in health work and to have demonstrated their value undeniably. No doubt we are somewhat prejudiced in their favor, but the record they have made in environmental sanitation and their ability in management and administration speak for them.

There is nothing mysterious about health work, and very little about it that a non-medical man cannot do as well or better than a doctor. The common-sense method is to let doctors take care of the purely medical phases; engineers of water supply, waste disposal and insect control; chemists and bacteriologists of laboratory work, etc. And may the man among them with the best administrative ability have a free and open opportunity to administer the whole. That is the way that will produce best results in giving the priceless blessings of good health to the greatest number.

A Newspaper Speaks on Sewage Treatment

Not long ago the *Antigo Journal* (Wisc.), in commenting on the news that a neighbor city was planning sewage treatment said: "The Shawano city council is going to enlarge its sewage system and build a sewage disposal plant. We don't know what the city has been doing with its sewage up to this time, but no doubt it, like many other towns, has been dumping it in the river or some other convenient place, which, however, is detrimental to the health of the people of that community as well as those further down the stream. The city of Antigo used to dump its sewage into Springbrook. It had to defend itself in a number of lawsuits for stream pollution and lost in all cases and paid damages. Today Antigo has one of the finest disposal plants in the country. . . . Improvements in sewage disposal have been made since (this plant was built), but it has been kept up in good shape and is handling the city sewage in a very satisfactory fashion. Shawano is to be commended for taking this advanced step to provide for the disposal of its sewage. Other cities that are still polluting lakes and streams should follow suit."

Such sound common sense, so well stated, doesn't need much comment.

Traffic Control by Brick Strips in Highways

Last month we called the attention of our readers to the possibility of employing colored strips in highways for warning and control. One of our readers suggests the use of hillside brick for warning of intersections and railroad crossings. This would seem to have many advantages. The brick color gives a visual warning equivalent to that of any other colored strip; the change in appearance of the pavement from concrete or bituminous to brick is, in itself, an invitation to drivers to slow down. Most of all is the peculiar and distinctive whine that tires make when driven over hillside brick.

It might take some little time to educate drivers to this type of warning, but not very long. If it were adopted as a general policy that all bad intersections, approaches to dangerous sections of highway, and all railroad crossings were preceded by 100 or 150 feet of hillside brick, the appearance and the sound would combine to register on motorists that it was time to slow down.

We believe that the idea has real merit and we commend it for the consideration of state, county and city highway authorities.

Widening a street

A repaved street

Ready for broken stone

Curb set, brick relaid

Utilizing WPA in City-Wide Street Improvements

By WILBUR L. DUNN

City Engineer, Uniontown, Pa.

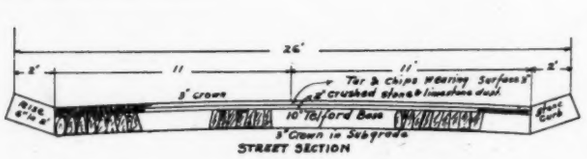
UNIONTOWN, Pa., a city of the third class, has a population of approximately 20,000; an area of a little over 2 square miles, and about 35 miles of streets. Five years ago about 15 miles of these streets were unimproved, and were maintained by scraping, rolling, and oiling each year, which was expensive and unsatisfactory.

Mr. Dunn

In November, 1933, we started our first work under CWA and built three streets and six sewers. These streets were graded, a course of stone 8 ins. thick broken by napping, shaped and rolled, and water-bound; afterwards a wearing course of blue stone chips and tar was laid and rolled.

The next year we changed the design of the roadway. A two-foot sloping stone curb is first laid to line and grade. The stones are selected and are usually 2 ft. x 10 ins. to 12 ins. faces and 10 ins. to 12 ins. thick; these are hammer dressed and laid as nearly true to line and grade as possible.

A 10 inch telford base is then laid and napped, filling all voids. Care is taken to lay the telford so as to leave no voids at the bottom. After napping, the telford is rolled, and roughly shaped to cross section. Crushed stone, ranging from 2½" to ¾" is then spread and shaped to cross section, using a road grader for the rough spreading, and finishing by hand spreading, using a template to secure a nearly true cross section. This course is about 2½ inches thick, and is rolled to solidify it; screenings and limestone dust are added, sufficient to fill all the voids, then watered, and rolled until all is thoroughly compacted and bound together, resulting in the conventional telford macadam roadway. The street is then opened and traffic permitted to use it until all voids are completely filled and the entire roadway firm and solid. Any depressions which may develop are filled and rolled.



Section of street with telford base and sloping curbs

After about three months, and in some cases after a winter's use, the surface is swept, and a course of ⅛" to ⅝" bluestone chips, 2½ ins. thick is spread. The first application of tar, DH2 Heavy, Pennsylvania Department of Highways specification, ½ gal. per sq. yd., is made and then bladed, mixing as thoroughly as possible and shaping to grade and cross section. This course is rolled as soon as the tar will permit.

A second application of 0.3 gal. per sq. yd. is made and about 40# per sq. yd. of No. 1 B chips spread and rolled. A final application of 0.3 gal. of tar per sq. yd. is made and enough chips to cover it lightly, about 5# per sq. yd., placed and rolled each day for a week. Traffic is then turned on. This results in a 10" telford base, 2" water bound macadam top, and 2" bituminous wearing surface, thoroughly coated and bound together with the heavy tar. Under traffic these streets develop the appearance of pre-mixed asphaltic surface, and are water proof and dustless.

This method is used for heavy traffic streets. On other streets the same method is used, except for the wearing surface. An application of ½ gal. per sq. yd. of tar, and from 50# to 60# of chips is spread and rolled. A second application of ¼ to 0.3 gal. of tar and 10# to 12# of chips is spread and thoroughly rolled. After allowing a few days for the tar to harden, traffic is allowed on it. The tar is applied by a pressure distributor in which it is heated to about 125° F, and the chips spread by mechanical spreaders attached to the rear of the truck body.

Our labor has been furnished by WPA for grading, quarrying and laying stone. The city furnishes power grader, roller, crusher, and trucks, with the exception of some trucking by WPA which amounts to about 4% of the total estimated cost of each project. We have constructed or now have under construction about 12 miles of streets, averaging 26 ft. in width.

This work is all carried on under the personal supervision of Percy D. Coates, Street Commissioner, who has developed a most efficient system in handling the work and has designed and built many appliances to fit certain peculiar conditions.

(Please turn to page 28)

Safety in Maintaining Sewers and Sewage Treatment Plants*

By LE ROY W. VAN KLEECK

Senior Sanitary Engineer, Connecticut State Department of Health

AMONG the miscellaneous safety equipment available to sanitary workers, safety belts are a necessary and reasonably priced accessory. When men in deep structures are overcome by gas or lack of oxygen or are physically injured their safe and easy removal is greatly enhanced by the use of these belts. They may be purchased from safety equipment manufacturers. Two men on the ground above the structure are required for rescue work.

Portable non-sparking blowers for ventilating manholes and tanks equipped with electric motors or gasoline engines are on the market. When dangerous gases or oxygen deficiency are detected in structures, men should not enter without proper respiratory protection until thorough ventilation has been instituted, preferably with one of these blowers. During the progress of work these blowers should continue the process of ventilating, and additional tests should be made from time to time.

When inspecting dark structures where flammable gases or vapors may be present, and in all hazardous locations, electric explosion-proof flashlights or extension lights should be used. The employment of ordinary flashlights or extension lights is unsafe practice because of the possibilities of short-circuiting or a broken bulb. Safety lanterns and extension lights meeting the requirements of the Underwriters' Laboratories are available from several manufacturers.

When dangerous atmospheres are not ventilated before men enter them, respiratory protection is necessary. In addition, if combustible gases are present, all possibilities of ignition must be prevented. Proper respiratory protection depends on the particular conditions but usually hose masks or some type of self-contained oxygen breathing apparatus are desirable. Hose masks draw air from uncontaminated atmospheres and may be used up to 25 feet of hose without blowers; with blowers (either hand or motor driven) as much as 150 feet of hose may be used. They are relatively fool-proof and reliable, although they have certain limitations. Such masks as well as self-contained oxygen breathing apparatus (one type supplies oxygen for 30 minutes; another type for 2 hours) may be purchased from safety equipment manufacturers.

Canister masks have a place in sanitary work, especially in connection with chlorination of sewage. It is extremely important to realize, however, that canister masks are only suitable for relatively low concentrations of toxic gases and that sufficient oxygen must be present to support life. Unless the all-purpose canister mask is used (suitable for all toxic gases including carbon monoxide but not in atmospheres deficient in oxygen), the canister attached to the mask must be specific for the gas to be encountered. Safety equipment manufacturers carry a complete line of these masks and can furnish full particulars.

Inhalators are used in conjunction with the prone pressure method of artificial respiration to stimulate the nerve centers of respiration and increase the ventilation of the respiratory tract. Their use is advocated by the American Medical Association and others as of definite value in resuscitation work. Both the H-H inhalator and the Davis inhalator are approved.

When repairs in structures that may contain combustible gases are necessary, non-sparking tools should be used. These tools are made of beryllium-copper alloy which is almost as durable as steel yet which conducts heat so rapidly that a spark from their use is impossible.

Not least among safety equipment is a good first-aid kit. Good first-aid practice holds major injuries to minimum severity and prevents the development of infection

*Concluded from the August issue.

In constructing the seventy-two miles of sewer forty feet below the streets of Chicago, every precaution is taken to avoid accidents or asphyxiation by gas. Several times a day a safety engineer tests the gas content at both top and bottom of every foot of length of each section under construction. Should these precautions fail to protect the men from sudden incursions of gas, a group of trained rescue workers is constantly on hand to go to their aid.

in a host of minor injuries. Prompt attention is essential. Tincture of iodine is recommended for cuts. For major injuries call a doctor. Instructions on first aid may be obtained from health departments, the National Safety Council, the U. S. Bureau of Mines, manufacturers of first-aid kits and others.

Special mention should be made of safety equipment for use in sludge digestion tank galleries or other enclosed structures around sewage treatment plants where sludge gas may leak or accumulate. Combustible gas alarms may be purchased from safety equipment manufacturers and these will flash a red light or ring an alarm or both if any appreciable concentration of combustible gas accumulates in the atmosphere. Their use is indicated under certain extreme conditions.

Flame traps, relief valves, condensate traps and pressure regulators are very necessary adjuncts to properly installed gas burning lay-outs at sewage treatment plants employing separate sludge digestion. Several serious gas explosions have occurred at sewage plants by failure to provide the necessary safety devices or by their improper installation. Manufacturers of such equipment or your State Health Department can be of help to you in selecting the proper lay-out of safety devices for burning sludge digestion tank gas.

In atmospheres subject to gas accumulations, including enclosed bar screen chambers, explosion-proof lighting fixtures and wiring should be installed. Manufacturers can supply many styles of explosion-proof lighting fixtures including wiring for Class A hazardous locations as defined in Article 32 of the National Electric Code. Explosion-proof (non-sparking) electric switches are also on the market. A common type has the contacts immersed in oil.

There is a host of miscellaneous safety equipment listed by safety equipment manufacturers to meet special needs. They range from the head (skullgards) of the workers to the feet (non-sparking shoes) and they all meet the emergencies of a special situation.

While the maintenance of sewers and sewage treatment plants is a dangerous occupation, the use of the proper safety equipment will greatly minimize these dangers and serious accidents may be largely avoided.

Manufacturers of Safety Equipment

The various kinds of safety equipment named by Mr. Van Kleeck in the above article are manufactured by the following firms:

General Safety Equipment

Davis Emergency Equipment Co., New York City; Mine Safety Appliances Co., Pittsburgh, Pa.; Pulmosan Safety Equipment Corp., Brooklyn, N. Y.

Portable Manhole Ventilators

Coppus Engineering Corp., 344 Park Ave., Worcester, Mass.; Home-Lite Corp., Portchester, N. Y.

Flame Traps, Relief Valves, Pressure Regulators For Sludge Digestion Tank Gas

Pacific Flush Tank Co., 441 Lexington Ave., New York City; Vapor Recovery Systems Co., Compton, Calif.

Non-Sparking Safety Tools

Ampco Metal, Inc., Milwaukee, Wis.; Beryllium Corp. of America, Reading, Pa.

Explosion-Proof Lighting Fixtures and Wiring

Crouse-Hinds Co., Syracuse, N. Y.; Economy Lantern Co., Dayton, O.

Explosion-Proof Electric Switches

General Electric Co., and other large electrical manufacturers.

Examination for Superintendent and Ass't Sup't of Filtration

At a date as yet undetermined but probably about the middle of November, the Milwaukee City Service Commission expects to conduct civil service examinations for the position of Superintendent of Filtration and Assistant Superintendent of Filtration to be in charge of Milwaukee's filtration plant which is nearing completion. The salaries of these two positions are on a sliding scale, that of Superintendent going automatically from $3600 to $4500 a year, and that of Assistant Superintendent going automatically from $2700 to $3420 a year. The salaries are subject to a small deduction because of Milwaukee's pension system but the benefits therefrom are more than worth the deduction since the city's pension plan is a very liberal one. Salaries are, of course, exempt from federal income tax.

In this examination local residence has been waived but American citizenship will be required. The examination will be conducted in such a way as to be worthy of the professional nature of the positions and the professional standing of the applicants will be fully protected. There need be no hesitancy therefore on the part of the well qualified candidates as to entering the examination. Further details of procedure will be announced later.

How to Explain Sludge Digestion to Laymen

Speaking of common sense, a sewage plant operator not long ago explained to a group of laymen visiting his plant about the action in sludge digesters: "Here the easily available carbohydrates, organic acids, and nitrogenous compounds such as proteins and amino-acids, and ligno-cellulose forms the substrate supporting spore-forming anaerobes, fat-splitting organisms and other bacterial life. Disintegration is effected by micro-organism multiplication and the resultant enzymatic secretions which peptize the solids, both being essential to proteolysis. For clarification, the process may be termed septicization." What do you suppose he meant?—*Official Bulletin, N. D. Water & Sewage Works Conference.*

Cement-Washing Gravel to Improve Adhesion

The use of local gravel in surface treatment and carpet coats has been tried in Southampton County, England, by the County Surveyor, Lt.-Col. A. C. Hughes. To improve adhesion, the gravel is treated with a cement wash, which provides a roughed surface desirable in many kinds of highway work.

Welded Steel Tanks for Sewage

One of the prizes in the James F. Lincoln Arc-Welding Foundation Contest was won by Lt.-Col. Michael J. Blew, research engineer, Department of Public Works, Philadelphia, Pa., on his paper, "Advantages of Arc-Welded Steel Sewage Tanks." William Landsiedel, Structural Engineer, Sewerage Commission, Milwaukee, Wisc., was awarded a prize on his paper, "The Largest Arc-Welded Job of Black and Stainless Steel Construction." Charles A. Pfeiffer, draftsman, Morrell Vrooman, Inc., Gloversville, N. Y., won a prize on his paper, "Arc-Welded Sewage Sedimentation Tanks." Each of these prizes amounted to $101.75.

Showing process of lowering a main. The pipe is raised, several inches of cribbing is taken out, and it is then lowered, and this is repeated along the full length of the section until the pipe rests on the new grade.

Cast Iron Mains Lowered and Relocated Under Working Pressure

By WM. G. MYERS

City Engineer, Harrisonburg, Va.

THE water supply of Harrisonburg, Va., a city of about 10,000 population, is obtained from mountain streams about 13 miles west of the city and brought to the distribution system through two mains, a 10″ and a 12″. The 10″ main was laid 40 years ago and the 12″ was put in operation about 17 years ago. These mains lie on either side of the highway, now known as U. S. Route 33, leading from Tidewater, Virginia, westward. During the past six months the State Highway Department has been reconstructing a section of this road about six miles long. The territory through which this route passes is rolling and required considerable cuts and fills, and when the plans and profiles of the new highway were completed it was found that about four miles of pipe line had to be relocated or lowered.

The city forces under the direction of the writer started work in January of this year to readjust the mains. In some locations the pipe lines were shifted along the right of way line, but in most cases they were lowered in place.

Since there was a main on each side of the highway, the usual method followed was to lower one main, the highway contractor meanwhile excavating as close to the other main as was practical with his power shovel. This method saved considerable labor on the part of the city, although on several occasions the shovel broke the main and the works were flooded until valves could be operated and pressure cut off the main.

Above the head of the author (in the white suit) can be seen the impression of a pipe that has been removed. Cut 13 ft. deep. Pipe line was relocated.

The method of procedure was to excavate by hand down to the pipe and then excavate a trench along one side of the pipe to the required grade, leaving banks of dirt at intervals to support the line. Cribs of 2 x 4s, two feet long, were built under the line and the banks of dirt were removed. The line was then ready to be lowered. Most of the lines were lowered by means of levers, four or five men lifting the pipe enough to remove several pieces of cribbing, and allowing it to settle gradually.

The pipe being bell-and-spigot cast iron with lead joints, it was necessary not to put too much strain on the bells; several bells were cracked during the work and had to be cut out and repaired with sleeves. In a great many instances the lines were lowered to the new grade without cutting the pipe line, depending upon the depth to be lowered, length of section, etc. In the cases where the excavation was located on a curve, the pipe was shifted towards the outside of the curve and lowered without cutting. Whenever it was necessary to cut the line before lowering, it was cut near a bell, the joint melted out with an acetylene torch, the pipe lowered, and the sections joined with short pieces and a sleeve.

In cases of rock cut, the lines were raised in order to give space for drilling and shooting, and burlap bags were placed around the mains to absorb the blast shock. Very good results were obtained by this method. Of course, the charges could not be as heavy as in ordinary trench work. Occasionally a line would be broken by the shot, but this was rare.

All this work was done with the mains under full working pressure, in some places as much as 85 to 100 pounds. In the process of lowering, some of the lead joints would leak, but it was a small job to keep them caulked as the pipe went down. When the pipe was finally lowered to the new grade, each joint was carefully inspected and caulked.

Patching and repairing the surface is a "steady" job.

Instructions for State H

(All photographs from Public Works files; drawing courtesy Mississippi Highway Dept.)

THE Mississippi Highway Department has issued to its maintenance superintendents a mimeographed list of 134 items of instruction, from which the following are taken:

Loyalty and Cooperation

Be loyal to the State Highway Department; be civil and courteous in your dealings with the public; and let your criticisms pertaining to the Department be constructive, and make them to your immediate superior only.

Cooperate with the local officials and interested parties and act through the instructions of your District Engineer in your efforts to get the proper drainage and connections at approaches of local roads and private drives. Furnish them with plans for local approaches and superintend the installation of such structures.

In the event of damage to culverts or bridges at private or public approaches, or damage to public or private property by any of our forces, report same immediately to your District Engineer and correct same at once, as per his instructions.

A superintendent's obligation to the State, in the way of securing efficiency from employees, is more important than leaving the impression that he is a "good fellow."

Road Conditions

Be particularly alert after rain or wind storms and keep your district office informed as to conditions. Make prompt reports on changes in conditions. The superintendent should ride over his road occasionally at night to observe the night conditions.

Safety

Do not put off or delay correcting a condition that is or could be hazardous to the traveling public. Keep warning posts at end of narrow bridges and culverts, and keep same striped or white by having them repainted when necessary. Keep warning signs up at all weak or questionable bridges. Demand that all of our moving equipment bear a red flag displayed properly.

Report sections of all types of pavement which have no center stripe, or need re-striping.

See that all trucks are equipped with a rear view mirror mounted properly. Warn employees against stopping or turning equipment at top of hills and in curves. Do not allow maintenance forces to leave equipment standing on the road. Do not permit truck, tractor, or road machine operators to take on passengers; nor allow anyone to ride with you except an employee of the State Highway Department.

See that gravel checkers, bridge crews, asphalt kettle crews, paving breaker crews, and all other crews which are stationary for any length of time, keep warning signs properly erected. A standard SLOW sign, should be used, mounted on a small stand and set up in the center of the road at least 400 feet in both directions from the crew. A red flag 18″ x 18″ size should be displayed above the SLOW sign on an arm extending from the sign stand.

See that all closed roads are properly barricaded and that they have the necessary warning signs and direction signs. Large striped boards should be erected at all dangerous turns and curves. When a superintendent finds a construction job improperly marked and barricaded, he should report it. All superintendents should keep a supply of torches and white blank boards so the proper warning signs could be erected immediately in case of an emergency or accident.

Efficiency and Economy

Do not have a regular schedule for your inspection tours.

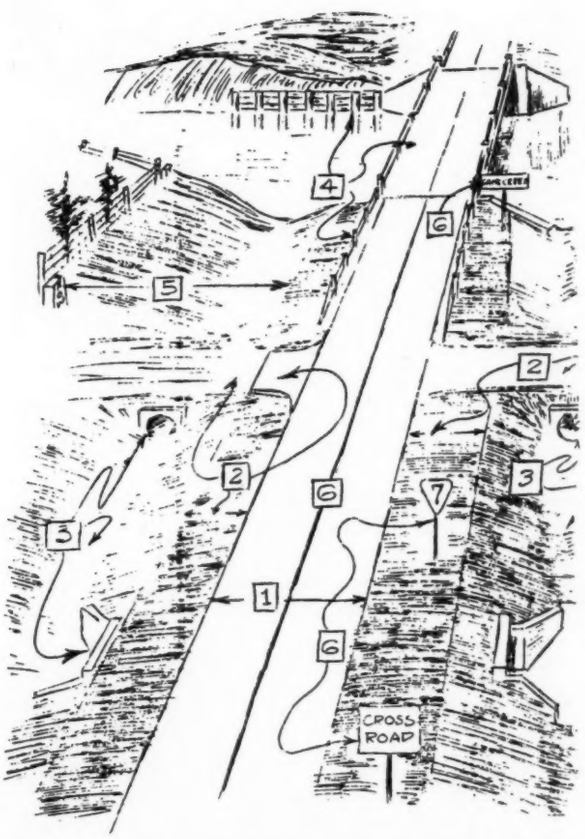
See to it that all outfits carry the proper number and kind of hand tools. See to it that all patrolmen do some hand work regularly, but that they do not neglect more important duties for it. When you find an employee getting exceptionally good results, find the cause by studying his methods, then pass the ideas on to others.

Ditches have to be kept open, too.

Check hours spent in actual work, both your own and those of your men, and determine whether results are what they should be. The maintenance superintendent and gravel checker should keep a diary in detail. Superintendents should keep a record book on all marked equipment and on all regular employees under his supervision. Observe conditions and methods used in other superintendents' territories, when you have the

The need for mowing comes with the summer season.

ate Highway Maintenance



Key to nomenclature in this article: 1, the surface; 2, shoulders and side approaches; 3, drainage; 4, structure repair; 5, roadside; 6, traffic service; 7, other.

opportunity and permission of your District Engineer.

Know that the tool or material is needed before you give authority to purchase it, also know that the prices are reasonable. Know that the extra labor is needed and will be used to the best advantage before you give authority to use it.

Study the relative importance of the various elements of the road in maintenance and endeavor to keep them balanced: Surface 40%, drainage and ditches 25%, shoulders 10%, major structures 10%, minor structures 5%, roadside cleaning 5% and traffic service 5%.

Waste oil from motors should be saved, but should NOT be used again for lubricating purposes. Pay particular attention to the conservation of road materials of all kinds, as: repaint steel and timber bridges before deterioration sets in; keep small washes in shoulders of gravel roads patched to hold gravel; do not permit patrolmen to push loose gravel too near edge of road; replace damaged wing pile covers, etc.

Have ditcher outfits assist in machining gravel or graded surfaces, when the weather will not permit ditching; and, when outfit is broken down, keep the crew busy on other work.

Reports

Mail daily forms and reports regularly and promptly. Instruct all patrolmen in making out reports and statements correctly. Caution all employees regarding the necessity of reporting accidents, and the necessity of making the report complete. Fill in all blanks on the accident report form. Report all accidents whether or not there is personal and property damages. Have all patrolmen report to the district office on their daily reports and to you, either by letter or orally, at the first opportunity, and you report to the district office in addition, ALL encroachments on right-of-way.

In your requests for labor, material and parts, state the number of the section or sections it is for, also the equipment number, and the account number. In requests for parts, give quantity desired, number and name of the part, and the equipment number.

Make a periodic report on each section to show general condition of section and efficiency of power unit and personnel.

Protection of Highways

Do not permit mail boxes to be erected on the shoulder of the road. Keep posted on "Rules and Regulations" in order that you may be able to inform the public relative to signboards, and structures adjoining the right-of-way. At regular intervals check and if necessary reset all right-of-way markers which erosion or filling-in affect. Do not allow anyone to place logs, lumber, cross-ties, wood, etc., on the road; nor to use the road and right-of-way for a loading yard or skidway location.

All cases of encroachment which you are unable to handle should be reported to the police patrolmen through the District Engineer. But in all cases warn the person who starts the encroachment as to the procedure for filing applications. Report all infractions of our

To maintain a smooth surface on gravel roads, drag after a rain.

"Rules and Regulations." Do not permit anyone or any town to use the right-of-way for a garbage dump.

Surface and Machining

Keep trash and foreign material thrown off the surface of the road. Keep shoulders smooth and the correct height at bridge ends. Add clay to loose gravel in pot holes. Instruct all patrolmen to stop long enough to drain water ponded on road. Ponded water should be drained off the surface immediately after rains.

Work with the idea of getting the outside of all curves on graveled roads elevated. Instruct machinemen in different methods of machining gravel surface: out, in and across the road. See to it that they use the proper method for the particular condition of the road. Do not permit a high and low side at ends of bridges. Machine dirt shoulders often enough to keep them smooth, the grass down, and in shape to permit drainage. But remove all grass, and foreign matter from earth pulled on to the surface. Do not permit pushing gravel near enough to edge of road that it will roll down slopes. Keep only enough crown on gravel surfaces to prevent water from standing.

See to it that the patrolmen give more attention to rough links than to smooth ones. Keep earth shoulders flush with surface of pavements. A shoulder high enough to cause the water to pond on the pavement is as unsatisfactory as a low shoulder. Keep cracks in concrete pavement sealed. Check expansion joints in hot weather to determine whether there is sufficient opening. If joint is closed open with paving breaker.

Learn all you can about asphalts and tars sent to you for patching purposes: label on drums, etc. Keep dates of application and watch results obtained and service obtained. Keep pavement smooth by patching. Gravel and earth washed or pulled on to pavement from driveways or intersecting roads should be moved at once.

See that clay and dirt is not pulled in on gravel surface during rainy seasons, and, if too much has already accumulated, see that machining is reversed and the surplus pushed off of the surface. A graveled surface with waves and bumps that cannot be smoothed with a machine should be scarified before resurfacing. Maintain ample crown in gravel and dirt surfaces at intersections of grades; that is: at the top and bottom of hills.

Ditches

See to it that the patrolmen with power outfits do the light ditching on their sections; that is: Keep the standard size ditches open, properly shaped, and free of grass, and provide binder for the gravel on links where they are able to ditch. See that the ditcher outfit makes broad ditches, and that the ditch is shaped to carry the water at the back and away from the road.

Where the road changes from a cut to a fill, cut the side ditch far enough away from toe of fill to prevent scouring of the fill. Ditch checks should be used in ditches emptying into side ditches and also in side ditches where needed. Checks may be constructed out of earth, sod, brush, stone or timber. When side ditches are pulled in late fall the surplus earth on shoulders should be moved immediately. Fill in deep ditches so that they can be traversed with road machine. Sod for stopping erosion in side ditches is preferable to stone riprap or stops.

For economical maintenance, modern equipment is needed.

Gravel and Hauling

See to it that the gravel checker understands just what his duties are. Some of the more important of these are: (a) Never issue a ticket for a load that he did not see dumped on the road. (b) See to it that the material is unloaded in proper quantities and proper places on the road to insure best results and least waste. (c) Check capacity of truck bodies often, and see that they are full when the truck arrives at the place for unloading. (d) Do not take truck drivers' or contractors' word for anything—he should be able to say that he saw it. (e) In case of shipped-in gravel, see that no material is left in cars. (f) When in doubt about the quality of binder clay get in touch with the superintendent. (g) Check and double-check the daily reports with tickets. (h) Be sure to make the necessary screen tests of gravel, as instructed.

Check up on your gravel checkers as to capacity of truck and length of haul. See copies of his tickets and YOU should measure bodies and length of haul. Pay particular attention to the quality of local gravel before using. Gravel checkers should carry picks to sound gravel surfaces ahead of patching. The patrolman should make a trip over his section with the gravel checker before patching or resurfacing in order to point out conditions that checker might fail to observe. Washed gravel should be clayed immediately after it has been placed on the road, unless there is sufficient clay or mud on the surface to bond the new gravel.

Cutting back bank slopes is another maintenance job.

Embankments

See that there are no washes in slopes of embankments. All embankments and cut slopes should be sodded. Do not permit maintenance forces to get dirt at toe of slopes nor on the berms. Sand shoulders on fills

should be pushed off to a depth of three or four inches and rebuilt with clay or soil and then sodded.

Bridges and Culverts and Drain Tile

Have ditches at inlets and outlets of culverts cut as wide as opening of culverts and the bottom of ditch flush with floor of culvert, and a regular declining grade of at least 0.2%. Do not delay repairing damages to bridges, broken floor plank, railings, etc. Keep sufficient ballast on floors of treated timber bridges. Pay particular attention that the water will not pond during the winter and there there is no loose gravel in dry seasons. Keep paved bridge floors clean, and drain holes on all bridge floors open at all times.

Keep tops of wing piles capped and handrails in good repair at all times. Do not cut or abuse creosoted lumber. Keep nails driven down in plank of timber bridge floors. Keep all bridges and culverts clear of driftage. After heavy rains, investigate conditions under bridges.

Where conditions require lines of field tile in the

Putting down a strip of road mix.

construction, inspect often and see that same function. Erect marker at each end of all lines of tile drains.

Where structures have the station number stenciled on them do not let fade out. Keep stenciled for reference, and keep marker posts erected and numbered at culverts and bridges which do not have number printed on them.

Roadside Cleaning

Pay particular attention to cleaning on inside of sharp curves and around road markers and signs and bridge ends. With a limited authority for extra labor for roadside cleaning, see that the right-of-way forces work where needed most. Do not permit bushes to grow under bridges and at inlets and outlets to culverts and bridges. Keep the ground scraped clean of grass and weeds under and around timber structures, and permit no inflammable material around or near timber structures.

Superintendents should not permit patrolmen or any employee within his charge to set fire on the rights of way, except at such points as are specifically designated by him and then only where there will be no possible damage therefrom either to the roadway or to adjoining private property. Patrolmen, particularly truck patrolmen, should be cautioned to watch for and extinguish fires along the right-of-way started accidentally by passing motorist.

Trees should be removed when they form enough shade to prevent the road from drying properly. Superintendents should study the question of roadside beautification and designate certain trees and shrubs to be left on the right-of-way.

A broom drag helps a lot to get a smooth riding road.

Signs

Keep road markers and signs straightened up. Instruct all patrolmen on this. Pay particular attention to detour marking, and see to it that the markers are maintained in good condition on detours. Report to District Engineer signs needed or destroyed. If you believe directional signs are needed at the junction of unnumbered road with numbered routes, make request for them.

Superintendents should keep a few of the various caution signs, and a few of each marker number in his district on hand to replace those destroyed or defaced. Where routes are marked on city streets which we do not maintain certain patrolmen should be instructed to check the condition of signs and markers on these streets periodically.

Care of Equipment

Do not overload or over-speed trucks and tractors. Get maximum efficiency from all units. Check equipment each time you see it to be sure that it is not being abused or neglected; and instruct operators to walk around their equipment twice each day, looking over the various parts. Check up on comparative operating efficiency of all equipment in your territory. Clean all equipment regularly. Keep all equipment painted and equipment numbers visible from four sides at all times.

See to it that the proper grades of oil and grease are being used in all equipment. Lubricate all parts according to instructions—that is, use proper lubrication at proper intervals of time. See that motor oil and grease are changed at regular and proper intervals.

See that patrolmen make monthly equipment reports and be sure that same are correct. See that operators understand when and how to clean air cleaners. Caution road machine operators that they must not discard cutting edges (blades) until they are worn out. That is: the blade should be worn down to the moldboard. See to it that your instructions are carried out.

See that all trucks have effective brakes and rear view mirrors at all times. Trucks must have license plates properly mounted. All equipment must be equipped with effective lights, mounted according to the requirements of the law.

General

Remember that the purpose of maintenance is to keep a smooth and safe surface for vehicles to travel on, and that all details are means to that end. AND BE LOYAL TO THE STATE HIGHWAY DEPARTMENT.

Twenty Questions . . .

How Many Can YOU Answer?

1. What do water works superintendents think about licensing?

2. What causes alkalinity in water and in what two ways is alkalinity measured?

3. What are the usual doses of activated carbon for taste and odor removal?

4. What are the best paints for steel water tanks?

5. Should water tanks be painted in hot weather?

6. What effect does cold weather have on the operation of chlorinators, and how would you prepare for this?

7. There are some 50 essential features in swimming pool design. How many can you mention?

8. How would you determine the pipe friction in a water works system?

9. What schedule is available for checking the efficiency of distribution systems?

10. What should be the moisture content of a soil for earth dam construction in order to obtain maximum density and compaction?

11. Why is some water corrosive, what causes corrosion, and how can it be controlled?

12. Can you identify algae, such as synura, synedra, anabaena and volvox?

13. What dosages of what chemical is needed to control growths of these?

14. How would you dampproof a pumping pit below ground water level?

15. What is the average monthly water consumption in percentages of the total for New England?

16. What are comparative bacterial efficiencies of anthracite and sand filters?

17. What is the difference in the average daily water consumption per capita between cities 100% metered and cities 10% metered?

18. How would you determine the correct chemical dosage for coagulation?

19. If phenolphthalein alkalinity is 150 p.p.m., and the methyl orange alkalinity is 196 p.p.m., what is the caustic alkalinity?

20. How would you compute the spillway capacity required for a small dam?

Key to answers appears on page 36

Excuse It Please

Gentlemen:

Kindly permit me to call to your attention an error in PUBLIC WORKS, Volume 6, Number 9.

On page 39 under the heading "The Metric System," the statement is made that 1 liter is equal to 100 cubic centimeters. This, no doubt, was caused by the printer dropping a zero. However, the third and fourth sentences under this heading may be very confusing to some readers.

Melvin H. Diven,
Supt. & Sec'y, Mount Union Borough Water Works.

Thank you, Mr. Diven. This escaped our proof reader. The sentence referred to reads: "This (the liter) is equal to 100 cubic centimeters, and also to 1,000 milliliters, the cubic centimeter being equivalent for all practical purposes to the milliliter." The latter part of this sentence shows that either the 100 or the 1000 was a mistake.

WPA in Street Improvement

(Continued from page 20)

We have also reset stone curbs, built new base and relaid several brick streets that were badly worn. The problem of proper underdrainage was solved by tile and stone drains deep along the curbs, and herringbone cross drains connected to them. On one of these streets, McClellandtown Road, a bituminous filler was used on the relaid brick.

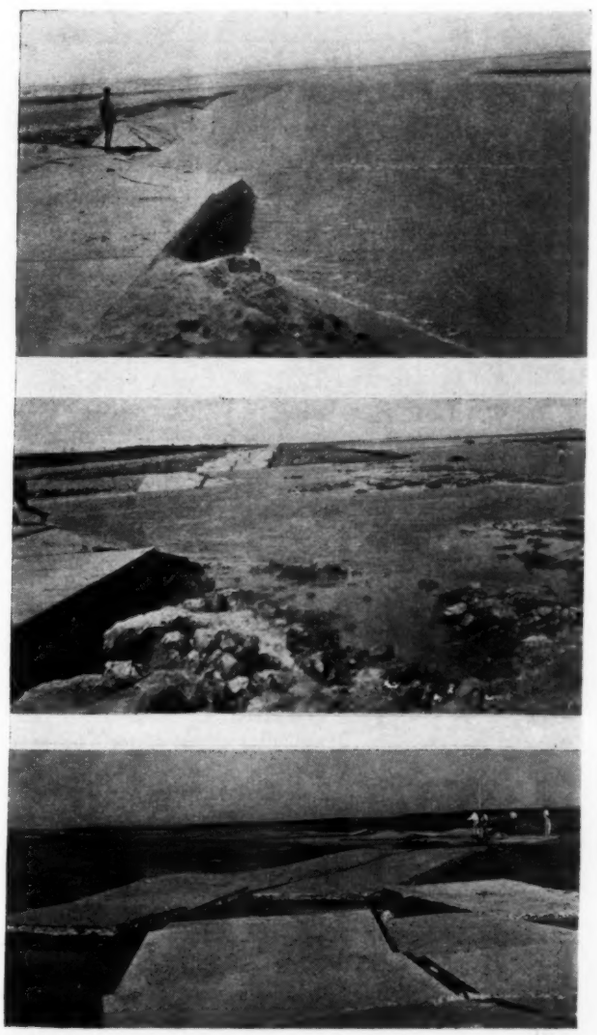
Plans and specifications for all unimproved streets in the city have been prepared and filed with the WPA office, so that there is no delay in starting work when a street is approved, as line and grade stakes are set.

No assessment to property owners has been made for these improvements, as is the custom with all other third class cities of which I have knowledge, the entire cost of materials, stone tar and chips being borne by the city.

Getting Ready for Hard Luck

PLANNING for disaster, which may come soon, or never, is not pleasant, but preparedness is just as necessary in civil life as in military affairs. Major disasters, defined as those "of such magnitude as cannot be met by the regularly constituted local agencies," may strike in the form of flood, earthquake, hurricane, fire or even epidemic. Cities should be ready for any of these, so far as this is possible. During the past few years, some thought has been given to this subject by water works officials and others, and in a recent issue of the *National Municipal Review*, Harry R. Betters of the United States Conference of Mayors outlines some of the factors in preparation:

Basically the plans that have been prepared are the same for whatever disaster. They recognize the necessity of a centralized administrative authority to assume responsibility for the direction and coordination of all activities. The two major functions under the centralized authority are: 1. The preservation of order and the protection of life and property, which is the duty and responsibility of government; and, 2, the provision for relief in the form of food, shelter, clothing, medical care and rehabilitation, normally carried out with the cooperation and under the direction of the American Red Cross.



When hurricanes and floods come, communications are disrupted; also, often power and water. The above WAS a concrete highway.

An Outline of Jobs to Do

These major functions may be broken down still further, as follows:

Government Responsibility:
- The protection of persons and property, including maintenance of law and order, the prevention of looting, public health and sanitation, care of the dead, and enforced evacuation of dangerous areas.
- Restoration and replacement, including water works, sewers, streets and highways, cleaning debris from streets, public buildings and other public property.
- Collateral services, including survey of damages, transportation, communication, salvage of property, inspection of buildings for safety, and publicity.

Red Cross Responsibility:
- Supplying necessities, including food, clothing, shelter, medical aid, rescue, and first aid.
- Rehabilitation, including maintenance of families, building and repair of homes, household furnishings, hospitalization, nursing, farm and other supplies, and occupational training and supplies.
- Collateral services, including survey of conditions, transportation, communication, public information, and registration and welfare inquiries.

As a groundwork for this planning, many types of surveys are necessary, with the data properly prepared for emergency use. Food, for instance, is of little value unless those who need it know where it is; emergencies require an unusual distribution of all commodities. For that reason, the sources and location of every kind of basic material, and the probable need for it, must be determined. In Los Angeles, the Necessities of Life Committee of the Red Cross has a complete list of stored supplies and their location. This complete and up-to-date list includes all food, bedding, clothing, cooking and serving equipment in southern California, in addition to stocks in San Francisco.

Other Details

The fire department must know where reserve water supplies, wells, cisterns, swimming pools and tanks are located; the location of all explosives must be known, for control and for purposes of demolition. Cooperation with the army, navy, national guard and organized reserves, as adjuncts to the police force, is needed. Surveys are required for determining available housing and refugee facilities in public and private buildings, churches, schools and open areas. Buildings, such as schools, stores, office buildings, apartments, churches, hospitals, dance halls and theaters may be classified in regard to their fire-resisting or earthquake resisting properties, in order to form a basis for prediction as to those sections that would require major aid in a disaster.

The net results of lack of planning, when disaster really strikes, are panic, unnecessary loss of life and property, disruption of essential services, and wasteful and uncoordinated effort for the protection of the community.

Left, the distributor spray bar rigged up to spray cotton fabric laid on the sloping bank.

Right, completed section showing first stone chips over the sprayed cotton fabric on canal bottom and left bank, after second application of bituminous material.

Placing a Bituminous-Cotton Lining for Canal Bottom

ASPHALT and cotton were used to line a section of the Northern Extension Canal near Grace, Ida. The methods described below were used on about 5,000 feet of this canal having the following dimensions: Bottom width 14 to 16 feet, and side slopes 2:1, with the lining to extend 6 feet up the bank slope. These dimensions provided sufficient capacity, with the grade available, for a flow of 128 to 140 cubic feet per second.

The first step consisted of applying a prime coat of 0.5 gallon per square yard of a light penetrating road oil—SC-1A, which has a Furol Viscosity at 122°F of 40 to 100. This was followed by an application of 0.25 gal. of 95+ liquid asphalt (a soft asphalt cement). On this was laid "Road Tex" cotton fabric, which is furnished by the Department of Agriculture, in rolls 84 ins. wide and 250 yards in length.

On top of the cotton fabric was applied another coat of the 95+ asphalt, using 0.50 gal. per sq. yd., followed by ⅝- to ¼-in. stone chips. This was rolled to final compaction and a seal coat of 0.25 to 0.40 gal. of the 95+ asphalt was applied, followed by a light application of small stone, ¼-inch to 10-mesh; this was then given a final rolling.

The photographs herewith show some of the work under way. All application of the road oil and asphalt was made with a Littleford 101 Utility Spray Tank, which was handled with a Monarch farm tractor. Some of the work was done with temperatures of 35 to 40°F. Clint Fulmer was the engineer in charge and the work was done by the Utah Oil Refining Co.

Photos Courtesy Littleford Bros.

This shows the distributor unit applying 90-95% asphalt on cotton fabric in canal bottom to prevent erosion and improve hydraulic properties.

Engineer's Contract for Sewer Improvement

Action was brought against a city for $20,000 damages for alleged breach of a contract by which the city employed the plaintiff to prepare plans and specifications for and to superintend the construction of a sanitary sewer within the city. The contract fixed the amount due as 2½ per cent of the total cost of the improvement. The trial court found the total cost of the improvement. These two facts, the Indiana Appellate Court held (Michigan City v. Brossman, 11 N. E. 2d. 538) affirming judgment for plaintiff for $2782 and interest, were a sufficient basis for the determination of the value of plaintiff's services or the amount due him therefor. It was held that by virtue of the contract plaintiff had vested rights lawfully acquired under and pursuant to the original resolution of the city for the construction of the project, to wit, a right to serve as engineer of the construction of the sewer in accordance with the terms of the contract, and a right to the performance by the city of its legal obligations assumed in that contract; and that these vested rights of plaintiff could not be interfered with by a subsequent improvement resolution rescinding action on the proceedings under the first resolution, and providing for construction under the second resolution, although the court expressly did not hold that the original resolution could not be rescinded by the second in so far as parties who had no vested rights under the first were concerned.

The Editor of Public Works asked a large number of city engineers and waterworks superintendents how they tested newly laid lines for leakage. Here are some of the many answers received.

Leakage Tests on Newly Laid Water Mains

TESTS for determining the leakage on newly laid water mains are made by nearly all water departments as a routine measure, but the methods differ among the various cities. The most common kind of test is to turn the water into the line before backfilling and observe if the joints leak. If a pressure of about 50% above that normally expected is employed in testing, and all dripping joints are recalked and defective pipe replaced, the leakage under service can be reduced to a very small amount. Deflections, under backfill, of improperly leaded joints, however, may permit considerable leakage to develop afterward.

Permissible leakage is usually stated in gallons per day per inch-mile of pipe. Various statements as to what is permissible on new lines have been made; in general, these vary from 60 to 120 gallons. On an 8-inch line, this would mean 480 to 960 gallons per mile per day. This leakage factor depends to a very large extent upon the number of house or service connections, which may contribute considerable leakage, and consideration should be given to this factor.

In Tucson, Ariz., Phil J. Martin, Jr., superintendent of the city water department, tests all new mains under 200 pounds pressure and checks all joints for leakage before backfilling; and joints that leak are then made tight. In Oxnard, Calif., A. L. Isham, Sup't., the lines are tested under 150 pounds pressure; in Redlands, Calif., Geo. S. Hinckley, city engineer, the section is closed off and pumped up, and the actions of a gage observed. The Peoples Water Service Co., Brunswick, Ga., Paul Killian, Manager, by-pass into the section being tested through a ⅝-inch meter, which measures the flow and shows the leakage over any period. Cedartown, Ga., J. E. Rainwater, Sup't., pumps into the section, using a pressure of 150 pounds. C. I. Goff, Sup't., Preston, Idaho, has been using a water test of about 125 pounds for 48 hours, but this year has been using an air test at 75 pounds, and prefers this, as it is faster. He reports that he has tested a 5000-ft. line with air. Leslie F. Larson, Sup't. at Galva, Ill., closes off the section and pumps water in through a hydrant. In Carthage, Ill., Roy Metz, Sup't., uses air and considers the line is free from leaks if no air is lost after a reasonable length of time.

F. E. Peterson, Com'r of Public Works, DeKalb, Ill., subjects the lines to 100 pounds pressure, checks all joints for leaks, and recalks those that need it. W. Kehoe, Chief Engineer of Fort Wayne, Ind., Water Department, fills the line with water and adds air pressure. The length of time required for the resulting pressure to reduce 25% is taken as an indication of the tightness of the line.

In Creston, Ia., Arthur K. Olsen, Sup't., the line is filled under normal pressure and allowed to remain for two days; if, by that time, there is no indication of any leaks, the line is covered. C. A. Miller, Manager, Kingsford, Mich., uses 80 to 100 pounds pressure for 60 minutes. In Jackson, Mich., David J. Stellingworth, Sup't., taps a corporation cock into the line and attaches a pressure pump, with which a pressure of 200 pounds is attained. In Faribault, Minn., I. E. Wilson, Water Commissioner, reports using 95 to 110 pounds pressure for testing. J. H. Fewell, Sup't., Jackson, Miss., uses a force pump to bring the pressure up to 150 pounds, after which it is left to stand for several hours.

The Passaic Valley Water Commission, operating for the cities of Paterson, Passaic and Clifton, Earl R. Mader, Assistant Engineer, make leakage tests on large lines only, as their record of better than 90% actually metered water indicates that they have and maintain an unusually tight distribution system. In Carthage, N. Y., C. W. McWilliams, Sup't., closes off all house connections, fills the line, and then takes water through a metered by-pass. C. Leland Wood, Sup't. of the Municipal Commission, Herkimer, N. Y., states: "In short lengths of newly laid water main, joints are left uncovered and the operating pressure of the water is used. Each joint is inspected thoroughly for leakage, and after several hours, if there is no apparent waste, the line is considered satisfactory. In long supply lines, which we built several years ago, sections of the line were tested to a pressure 50 pounds greater than the operating pressure at the point of test. A water meter and pressure gage outfit was assembled and located at the point where the test pump operated. If the leakage was less than that prescribed by the AWWA specifications, we accepted the work."

In Hudson, N. Y., J. McClure Wardle, Sup't. of Public Works, the main is filled with water by pumping through a test plug, meanwhile observing that a pressure gage does not fall off appreciably during a 15- to 30-minute period. Of course, the main must be entirely filled with water so that no compressed air expands to keep up the pressure. In Seneca Falls, N. Y., S. W. Pratt, Sup't., the mains are held under pressure for 24 hours.

W. R. LaDue, acting sup't., Bureau of Water Supply, Akron, O., reports that the mains are tested under approximately 100 pounds pressure, and that the leakage limit is 100 gallons per day per inch-mile. Orrville, O., A. D. Webster, Sup't., uses an over-pressure test. Dallas, Ore., W. L. Soehren, Mgr., allows lines to stand 24 hours under pressure. Shippensburg, Pa., S. K. Breese, Sup't., makes leakage tests on small installations with normal main pressures only. On long lines, of several hundred feet or more, an air compressor and gage is used for testing.

R. L. Lawrence, Jr., Sup't. and Chief Engineer, Nashville, Tenn., says: In measuring leakage, we use ⅝-inch meter coupled with a Ford Meter Box Co. "Gulper" to register accurately very low rates of flow. The Gulper contains a bellows which accumulates very slow leakage and then discharges it in a slug or gulp through the meter at the rate of 2 gpm., at which rate the meter is designed to register accurately. When using Hydrotite or Leadite joints, allowable initial

leakage is approximately 13 times allowable values for lead joints. Final allowable leakage (30 days after initial tests) is the same as for lead joints. Leakage must not exceed these rates, in gallons per hour per joint:

3-inch	0.0304 gals.	12-inch	0.1216 gals.
4-inch	.0400	16-inch	.1616
6-inch	.0608	18-inch	.1824
8-inch	.0800	24-inch	.2416

No test is required on 2-inch pipe, but the joints are carefully inspected for leakage, while under pressure.

Sherman, Tex., R. S. Russell, Sup't., tests lines under 150 pounds hydrostatic pressure for 6 hours. Wenatchee, Wash., William R. Chapton, Ass't. City Engineer, tests newly laid lines by water pressure, from 30 to 100 pounds, depending on main pressure in that area. Pipe is also hammer tested, while under pressure, to find cracked pipe or loose joints.

The above cities are those that depart from the fairly standard and uniform method of testing by turning the water in under regular main pressure, and observing the joints before backfilling. About 30% of the cities reporting do not make any leakage test at all.

Overflow of Stream Running Through City

A city acquired by devise the property and franchises of a water works company which supplied the city with water from a stream which ran through the city. By agreement with riparian owners the water works company had constructed a dam, diverting the water into a distributing reservoir and filtration plants. The overflow passed over a spillway back into the stream. In 1935 the premises of a property owner in the city near the stream were damaged by a disastrous flood, caused by heavy rains raising the stream to a height resulting in flood conditions. For this damage the owner sued the city, contending that it was obligated to maintain the stream within its banks in such a manner as not to injure adjacent property.

After a trial the New York Supreme Court, Special Term, Otsego County (Wright v. City of Oneonta, 1 N. Y. S. [2d.] 295) granted a motion to dismiss the complaint on the ground that plaintiffs had failed to establish facts sufficient to constitute a cause of action. It held that the city has no greater rights than an individual or than the water company. It was not entitled to change the channel of the stream so as to deprive lower riparian owners of the natural flow of the stream as it passes from the city's property, nor so to increase or augment the flow as to damage riparian owners.

The owner of land through which a stream passes may use it and divert it upon his lands, provided it is returned to the normal and natural channel as it passes from his lands. Whatever the city had done to the channel of the stream was done upon its own property. The city's liability, if any, must rest upon the theory of its negligence in the performance of duties incumbent on it with respect to the maintenance of the channel. No duty rests upon a municipality through whose boundaries a stream passes in whole or in part to keep it in safe condition or free from obstructions not of its own causing. And no such duty rested on the water works. A municipal corporation is not liable for damages because of an increase in the volume of surface water, so long as the flow of the water was not diverted from its natural course; nor is it liable when collected surface water causes a stream to overflow its bank. Municipalities are not insurers against damages caused by the entry of surface waters upon private premises. Applying these principles, it was held that the evidence did not warrant a finding that the city had interfered with, deflected, changed, or increased the hazards from the stream. It was not obligated, either as a municipal corporation or as a successor to the rights and liabilities of the water company, to protect, by dikes or otherwise, property adjacent to the channel of the stream.

New Standards by the A. S. T. M.

For some time, Committee A-1 of the American Society for Testing Materials has been developing standardized requirements for spiral welded pipe and there has now been issued a new specification (A 211—38T) covering spiral welded steel or iron pipe 4 in. to 48 in. in diameter inclusive, with wall thickness from 1/16 in. to 11/64 in. manufactured by the following electric-fusion-welded processes: spiral lap-welded joint, spiral lock seam welded joint, or spiral butt welded joint.

In order to cover spiral welded material greater than 3/16 in. in thickness, tentative revisions are being published in two existing specifications covering electric-fusion-welded steel pipe of sizes from 8 in. to 30 in. and sizes 30 in. and over.

Concrete Aggregates

Since specifications for aggregate for concrete ordinarily include a limitation on clay lumps, Committee C-9 on Concrete and Concrete Aggregates has developed a test method for determining the amount of lumps in aggregate (C 142—38T). This is a necessary complement to the existing specifications covering concrete aggregates (C 33—37 T). Requirements are given for taking the sample. The sample is then to be spread in a thin layer on the bottom of the container and examined for clay lumps, any particles which can be broken into finely divided particles with the fingers being classified as clay lumps. After all discernible clay lumps have been broken, the residue from the clay lumps is to be removed by use of sieves which are specified. The percentage of clay lumps is then calculated to the nearest 0.1 per cent in accordance with a given formula.

Asphalt Plank

The use of asphalt plank and consistent demands for standardized specification requirements led the Society's Committee D-4 on Road and Paving Materials to begin study of this material several years ago. This has just resulted in new specifications (D 517—38T) covering plank of two types as used for bridge floors, namely, plain and mineral-surfaced. The plank is defined as a mixture of asphalt, fiber, and mineral aggregate formed by extrusion under sufficient pressure to expel the air and form a dense mass. The requirements in the specifications cover mineral filler, dimensions, absorption (not to exceed 1.0 per cent by weight) brittleness and indentation. Procedures are given covering brittleness and indentation tests.

Contractor's Bond Claims

The New York Appellate Division (American Surety Co. v. Wells Water Dist., 1 N. Y. S. [2d.] 615) held that the surety on the bond of the contractor for construction of a water supply system was liable to all claimants furnishing labor or materials in connection with the construction contract whose claims were proven, although they had been held not entitled to share in the fund remaining in the hands of the municipal authorities.

A powerful International TD-40 Diesel TracTrac-Tor opening a road in northern Maine. Drifts like this are a real test of equipment. Bank on International to lick them.

Build an Effective Snow-Removal Program with INTERNATIONAL POWER

Circle: When snow falls on Manhattan, International Tractors get it off the streets and walks. The City of New York owns 600 of these units.

• POWER means everything when it comes to keeping snow under control. Snow-removal programs stand or fall on the power behind the snow plow. Assure the free movement of traffic during the winter by turning this tough job over to International Trucks and Tractors. These International Harvester *quality* products have an impressive reputation throughout the snow belt for the *power* and *dependability* they bring to this winter job.

International Trucks are available in sizes up to six-wheel units, making them especially adapted to meet a wide range of requirements. International Tractors include five different models of TracTracTors (crawlers) and five models of wheel-type tractors. Plan your snow-removal strategy around International equipment for real effectiveness. Put International Power to work with the help of the nearby International dealer or Company-owned branch.

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An International Truck cleaning up after a blizzard. International dual-drive six-wheelers have proved highly efficient cutting out drifts.

The small, compact International I-12 is an ideal unit for sidewalk and cross-walk plowing.

INTERNATIONAL HARVESTER

Betterment in Maintenance by Partial Stabilization

By B. C. TINEY
Calcium Chloride Association

THERE is a decided trend toward the practice of consolidating the loose aggregate on traffic-bound road surfaces by the use of cohesive soils and moisture. The principles of soil-aggregate stabilization have previously been used largely in the construction of new surfaces or bases but this development is now beginning to find a most practical application in maintenance.

In the earlier history of traffic-bound roads the primary objective was to place a sufficient amount of gravel, crushed stone or slag to keep traffic out of the mud in wet weather or out of loose sand in dry weather. Aggregate with little or no fine filler or binder material was frequently used. Compaction under traffic was a long, slow process and perhaps never fully attained. When the motor vehicle replaced the horse, these loose dusty roads became not only very hazardous but also very expensive. Professor R. A. Moyer of Iowa State College speaking before the 24th Annual Road School at Purdue University on the subject, "Developing Non-Skid Road Surfaces," comments as follows:

"Sand, gravel, cinders, or macadam surfaces can provide a uniformly high resistance to skidding in the wet or dry condition, provided the surface is firm and reasonably free from loose material. Loose aggregates, especially sand and gravel pebbles, act as ball bearings under the tires, causing variations in the skidding resistance which make it difficult to steer, and are, therefore, responsible for many accidents. . . . The loose condition creates another serious hazard—the dust hazard—which interferes with visibility. It also increases the cost of transportation in the form of increased fuel, tire and car repair costs, and road maintenance costs which more than justify the cost of stabilizing the surface. Engineers and road officials should realize that untreated surfaces are expensive and dangerous, and take much of the pleasure out of driving for the present-day motorist."

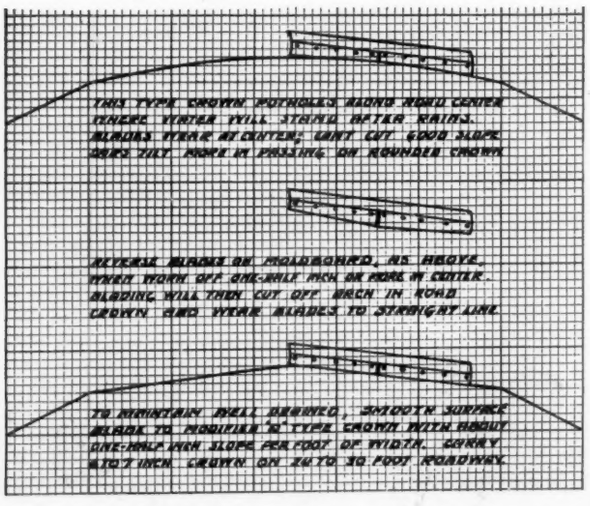
The untreated gravel or crushed stone road surface becomes dusty in dry weather and develops an appreciable amount of loose aggregate. It has been common maintenance practice to windrow this loose stone to the side of the road, to be bladed back again during wet weather. While this practice is admittedly better than leaving the loose material under the wheels of traffic, it is illogical, in that the windrowed material is giving no service to traffic but to the contrary constitutes a hazard to emergency use of the shoulder and obstructs the flow of storm water.

W. H. Root, Maintenance Engineer of the Iowa State Highway Commission, has this year adopted the "consolidated surface" method of maintenance in place of the "mulch" or "floating cover" method on the approximately 3,000 miles of traffic-bound road in the state system. In Mr. Root's instructions to his field organization, he lists the following objections to the "mulch" method:

"1.—In dry weather the loose gravel on the road surface may cause skidding.
2.—The mulch acts as an abrasive and actually causes raveling of the gravel mat.
3.—Much of the loose material is ground up by traffic and blown from the road or the aggregate may be thrown from the road by fast moving vehicles resulting in heavy losses of valuable road material.
4.—The windrow of material on the shoulder of the road may cause snow drifting on the road surface and this windrow is also a handicap in snow removal operations.
5.—Mulch maintained gravel roads are practically always dusty roads. This dust is not only a nuisance to the traveling public and occupants of adjacent property but is a potential danger factor."

Smoothness of traffic-bound surfaces is just as important to the traveling public as the elimination of dust and, in this connection, the amount of crown and the shape of the cross-section have a very definite bearing on the preservation of smoothness. It has been common practice to maintain traffic-bound roads with a parabolic cross-section and this leaves the middle portion of the road too flat for proper drainage of storm water. Small pools of water remaining on this flat portion cause pot-holing and increase the work of maintaining smooth-riding qualities. It has been definitely shown that this condition may be avoided by maintaining a flattened "A" cross-section with slopes of one-half inch per foot. This amount of crown is not uncomfortable or hazardous for traffic and for the same total amount of crown, the modified "A" cross-section gives less side slope than the parabolic section to cars traveling in their proper traffic lanes. In accomplishing the change from parabolic to modified "A" cross-section, it has been found in the Iowa work that an interchange of graded blades which have been worn to a slightly curved formation, greatly facilitates the operation. This is illustrated in the accompanying chart.

The consolidating or stabilizing of loose aggregate on road surfaces is a maintenance operation and may be accomplished satisfactorily by the so-called "trial



A crown of the flat A-type is desirable on stabilized roads.

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 62-65

and error" method. This method consists essentially of mixing a trial amount of pulverized clay or clay combination soil with the loose aggregate. The trial amount is usually about 10% of the volume to be consolidated. Water is added and the mixture is shaped and compacted under traffic. The dry mixture may be windrowed to be bladed into the road during the next rain. If the local soil from the shoulders is of a cohesive nature, it is frequently used and bladed into the loose aggregate as binder material. The preservation of moisture in the mixture is very essential and is accomplished by surface application of calcium chloride.

If the road surface shows a tendency to muddiness in wet weather, an excess of binder-soil is indicated, and this is corrected by a light application of coarse sand, fine gravel, crushed stone or slag. A tendency of the surface to ravel in dry weather shows a lack of binder-soil, and a slight additional amount is worked into the surface to correct this condition. The behavior of the road under traffic in both wet and dry weather thus becomes the practical means of establishing a balance between aggregate and binder-soil.

This method may seem crude, but it is practical and effective. Experience with local soils and aggregates soon enables the superintendent to reduce any necessary correction to a minor amount; an alert maintenance organization can correct any unsatisfactory condition promptly, before it becomes an object of public criticism. It is true that laboratory design and control afford a more nearly perfect initial combination of materials, but the fact remains that even designed surfaces must meet the final test of traffic, weather and subgrade conditions and sometimes require field correction.

Road dust is not only a nuisance and a traffic hazard but these fine soil particles, if kept moist, constitute a valuable filling and cementing material which prevents loosening and loss of the larger stone.

The consolidation of loose surfaces with binder-soil and calcium chloride has economic advantages. When a gravel or crushed stone surface becomes thoroughly dry, traffic begins to take its toll. Just as smoke is a sign of fire, so dust is a sign of road destruction. The annual loss of aggregate from an untreated road has been variously estimated by engineers as 100 to 300 cu. yds. per mile. In addition to this, the consolidated surface requires much less blading than the loose surface. Savings from these two sources will largely or wholly offset the cost of treatment and soil additions. The effectiveness and length of life of calcium chloride treatments are greatly increased on roads having the proper soil content.

The advantages of this type of maintenance are obvious to the highway engineer or official who analyzes his local conditions as to cost of annual replacement of stone or gravel necessary to preserve the original thickness of his roads, and also considers the factor of reduced blading costs on the consolidated surface. This method provides an intermediate stage of improvement which produces a higher class surface with greatly increased serviceability to traffic, at extremely low cost.

Controlled Concrete Mixing

The benefit to be derived from strict control of concrete mixtures and frequent testing of materials and concrete cubes is well illustrated by the experience which has been gained on Winchester By-pass, Southampton County, England. Lt.-Col. A. C. Hughes, County Surveyor, reported that during the early stages of the work the average crushing strength of concrete cubes was 1,250 lb. per square inch at seven days and 2,600 lb. per square inch at 28 days, using ordinary cement. By repeated adjustments in the mixture and careful selection of the aggregates, the strength of the cubes has been increased to 3,300 lb. per square inch at seven days and 5,600 lb., per square inch at 28 days.

On the Ringwood By-pass a number of experiments were carried out in conjunction with the research department of the Ministry of Transport, using different types of expansion jointing material and dowel bars. It is too early yet to draw any conclusions from these experiments. A length of concrete road 300 feet long was also laid at Ringwood without expansion joints; there were, however, several construction joints as the whole length could not be put down in one day. Within a few months of laying, and before the road was opened to traffic, serious cracks due to shrinkage of the concrete appeared at some of the construction joints, and it became necessary to carry out repairs. The conclusion drawn from this experiment is that, in England at least, expansion joints are an absolute necessity, and that the length which has been adopted for the bays, i.e. 30 feet, is correct.

Snow Removal and Sidewalk Plowing

(Continued from p. 18)

about 100% by using sanders, and, of course, a much more uniform job can be done.

All of our equipment is operated on a rental basis for accounting purposes on all county and township as well as state roads, using the same rental rates allowed by the State Highway Department for work done on state highways. When the equipment is operated efficiently, a small operating profit can be shown between the actual cost of operating the equipment and the rental allowed. This operating profit is placed in a special fund which we call our "Machinery Fund," and from this fund we purchase replacements and new equipment as needed. Last year our rental receipts for the year's operation were approximately $150,000, and our operating costs about $105,000, leaving a $45,000 operating profit available for purchasing equipment. Our operating profit has been sufficient each year so that it has not been necessary to ask our County Board for an appropriation for equipment.

For the past several years we have felt that our equipment is entirely adequate to handle the worst storms that may occur. Our concern at the present time is to reduce the cost of snow removal by more effective drift prevention and better trained personnel.

TWENTY QUESTIONS

Answers to the Twenty Questions on page 28 are to be found in the following issues of PUBLIC WORKS: 1, July, 1937, p. 38; 2, June, 1937, p. 61; 3, March, p. 41 and April, p. 28, 1936; 4, July, 1936, p. 21; 5. August, 1937, p. 20; 6, October, 1936, p. 29; 7, February, p. 16 and March, 1937, p. 17; 8, March, 1937, p. 20; 9, June, 1937, p. 25; 10, June, 1935, p. 15 and February, p. 17, 1936; 11, June, 1937, p. 64; 12, April, 1937, p. 24; 13, April, 1937, p. 26; 14, June, 1936, p. 34; 15, September, 1934, p. 9; 16, January, 1935, p. 45; 17, July, 1935, p. 26; 18, March, 1935, p. 27; 19, June, 1937, p. 63; 20, January, 1936, p. 15.

GET THE JUMP ON WINTER WEATHER

et ready NOW to buck away winter's heaviest ifts. Keep the taxpayers on roads and streets that e clear of snow and ice—open roads and streets at reduce winter accidents to a minimum . . . at make it easy for children to get to school, for orkers to reach offices and factories, for everyody to travel to and from social gatherings safely . . that help business. Check your snow removal quipment. See if it's in shape to take the battering f a stiff winter. If not, replace it now—with fastoving Allis-Chalmers equipment. Instant Startg, even in sub-zero temperatures, enables you to et on the job sooner. There's plenty of reserve ower for smashing through frozen, hard-packed ifts. More and higher speeds, ease of handling, uick pick-up and superior hill-climbing ability nable you to cover more ground in less time . . . low operating costs that make the taxpayer's ollar go further, summer or winter.

(Above)—Snows come early and stay late in Canada, but Sullivan, Province of Quebec, keeps its streets open by using a K-O tractor and Baker snow plow. Here the outfit, working in "42 below" weather, makes short work of hard-packed drifts. *(Circle)*—Wolcott, Vermont, another city where drifts pile high, keeps its streets open with an M tractor and Baker plow. *(Below)*—WM tractor and Hough loader clearing snow in Holstein, Wisconsin. If desired, this outfit can be fitted with a "V" or angular type blade for pushing snow. Change from bucket to plow, or vice versa, requires less than 15 minutes.

Ask your Allis-Chalmers dealer about snow removal equipment. Get the jump on winter weather NOW.

ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

Removing Snow and Controlling Icy Roads in Maine

By A. J. WIGGIN

Superintendent of Maintenance, Maine State Highway Commission

SNOWFALL varies, governed by air currents and temperature. On fifty miles, for example, there might be ten miles of the fifty miles on which we would expect double snowfall on account of elevation and temperature. Therefore, removing snow on over 12,000 miles of road has taught us to set snow removal equipment to meet these different conditions. On the seacoast area, we do not expect as much snow as we do farther inland, as in the extreme northern portions. Therefore, the size and number of pieces of equipment varies. In some instances, we have considered larger and smaller one-way blade plows, and a 10-foot or 12-foot wing on each piece of equipment. This wing, always on the right side of the truck, will generally take care of the average snowfall. In some instances, we will have a large "V" plow and one wing attachment in case of an unusual snowfall to set back the snow shoulders. We can change from a large blade plow to a large "V" plow in about thirty minutes or less.

In regard to how many additional plows should be provided in case of emergency or break-downs, we do not figure just this way as a rule. We arrange the snow removal equipment with such mileage that if a piece of equipment breaks down (it is usually only a few hours before it can be repaired) the mileage is extended for each piece of the remaining equipment in that area to take care of the emergency. In other words, we try to keep in use all our equipment, therefore there are very few pieces of equipment additional.

Our equipment starts out when there is one inch of snowfall. We keep this equipment moving until the storm is over, therefore not plowing over three or four inches of snow at any time. Unless there is an extremely heavy snowfall, we plow from 20 to 30 feet wide, whatever the road width may be, and set back the snow shoulders or widen after the storm is over.

We have found from many years of experience that each piece of equipment should be set for short sections of road, that is, sometimes a section is not over ten miles, and up to fifteen or twenty miles. Handling snow removal this way, the snow will not accumulate more than two, three or four inches in depth, and can be handled easily, and does not require too large equipment. Therefore, it can readily be understood that it reduces the cost of snow removal.

We plow as close to the pavement as possible, and usually are able to keep seven or eight feet bare in the center. On some roads, the entire width of the road is bare—it may be 20 or 30 feet in width—depending, of course, on traffic requirements.

We have quite a heavy line from Kittery to Portland. It is a 3-lane and 4-lane road. In this instance, we have been able to take care of the snowfall with blade plows. They will scrape the surface clean of snow, and we generally use the equipment in the following manner.

We keep a two-way road open so vehicles can pass. and run two plows close together, that is, not over fifty feet apart, one directly behind the other. The first plow is usually a 1½-ton blade plow, and that carries the

snow windrow to the side; and the larger blade plow picks up this windrow and what snowfall there is on the pavement, and carries it to the side. We do this to prevent as far as possible the snow rolling down with traffic. These two plows have a section of approximately ten miles in length. We vary these sections because there is a variation of snowfall, and usually the snow is damp and rolls down quickly. Therefore, we try to move it before it rolls down hard.

There is no definite method to pursue, but judgment is to be used when removing snow in every storm, because the storms are always a little different. In other words, as you know, there are no general instructions that can be given without a few changes and good judgment used. This has always got to be done in order to carry on the work efficiently.

We sand all slippery pavements, using in the sand either salt or calcium chloride. We found what we expected years ago, especially on the coast of Maine, that the cost of sanding slippery pavements would exceed the cost of plowing.

Where the snowfall is heavy and there are high winds, we have in the last ten years been able to erect many miles of snow fence, which is very valuable, to prevent drifting conditions. It costs less to keep the snow off the road than it does to remove it with plows.

We use a great many blade plows. We try to have blade plows attached to 1½-ton jobs, and in some instances 2-ton jobs, to clean the surface of the road. We cannot depend on "V" plows for this work.

Assumption of Risk of Excavation

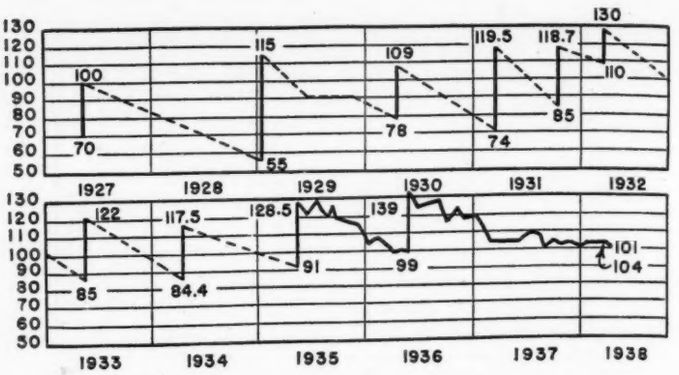
A city and a railway company undertook to repair a sewer running under a roadway and a ditch was dug, five feet wide and five feet deep, the edge of which was only six inches from the property line of an adjoining owner. The front porch of the residence was so close to the ditch that a guest, rising from her seat on the porch, eighteen inches above the surface of the ground, turned her ankle and in an effort to balance herself, fell into the ditch, sustaining a broken leg and other injuries. In an action against the railway company and the city, the West Virginia Supreme Court of Appeals held (Lowe v. Norfolk & Western R. Co. et al., 195 S. E. 593) that the plaintiff must be deemed to have had knowledge of the existence of the ditch. The defendants could not forsee the unfortunate accident, and were under no legal duty to anticipate the unusual, nor to guard against consequences which could not reasonably be expected. By seating herself where she did plaintiff assumed a patent risk and shared with the defendants the responsibility for her accident. A person thus contributing to his own injury may not recover damages though the defendant be not free from blame. The defendants' conduct in leaving the ditch open and unguarded, it was held, have constituted negligence which in other circumstances of injury to a person, would have afforded ground of recovery, but for the reasons stated, the plaintiff could not recover.

Longest Road on an Even Grade

The oil pipe-line road between Haifa, the Palestine port, and Baghdad, the capital of Irak, will be surfaced with asphalt over its entire length of 600 miles within the next two or three years. When completed, it will be the longest road in the world on an even grade. The cost of the road will be £600,000. A year or so ago, the readers of this magazine had quite a contest over who had the longest tangent. Can any of our readers beat this for a long and uniform grade?

WATERWORKS DIGEST

Abstracts of the main features of all important articles dealing with waterworks and water purification that appeared in the previous month's periodicals.



COEFFICIENT CHANGES, 16-INCH TAR COATED CAST IRON MAIN LAID IN 1905 IN WESTCHESTER COUNTY, NEW YORK. SURFACE WATER FILTERED AND TREATED WITH LIME. HARDNESS 35-40

Effect of cleaning cast iron mains about once a year

Water for New York's World's Fair

ALL utilities for this fair were designed to serve a maximum of 800,000 visitors a day; using for kitchens, concessions, drinking fountains and comfort stations 2.5 mgd average, 12.5 mgd maximum hourly rate. For a major conflagration, 9 mgd (by temporary curtailing of air conditioning). Also an hourly draft rate of 4.8 mgd for irrigation of plantings (mostly at night). For fountains and water-using display features recirculation is mandatory, but 400,000 gpd is provided for make-up water. Water for all purposes except display is taken from New York City transmission mains, one of which 20" diameter crosses the fair site on pile foundations. In soft ground, water and sewer mains are carried on heavy stringers carried by piles. Water has been supplied to the fair grounds for some time, that used now being equivalent to the demands of 6,000 population.[E43]

Cost of Softening Water

STUDIES of actual costs of softening water in mid-west cities indicate that these vary from $10 per mg additional for surface waters that are treated for purification, to $35 or $40 for ground waters that receive no other treatment. In five cities, the costs for chemicals alone per mg per ppm removed ranges from 5.5c to 6.5c.[F59]

Limestone or Marble For Corrosion Control

Two full-scale plants in the U. S. control corrosion with calcium carbonate, Dillsburg, Pa., using limestone and Creedmore, N. Y., using marble, used as contact beds. Both give material reduction of red water, with disappearance of iron tastes and increased clarity and sparkle at Dillsburg. Advantages of this treatment are simplicity and economy in operation, practically automatic chemical control, increase of calcium content for very soft waters, and impossibility of overdosing. Disadvantages are initial cost of installation, particularly for large supplies, and lack of sufficient contact to produce complete equilibrium or saturation without extremely long contact periods. Might be useful as a preliminary roughing process: would stabilize the chemical constituents to a considerable degree and might reduce cost of chemicals. Will not serve for forming protective carbonate lining in pipes.

Basically the process is simply the marble test not carried to completion. Its efficiency is dependent on size of the contact particles, temperature of the water, its carbon dioxide content and the alkalinity or other dissolved minerals present. Reaction at 20° C. is twice that at 10° C. If alkalinity is above 50 ppm or CO^2 above 30 ppm, reaction is too slow to be economical.[A125]

Sodium Aluminate and Silicate for Corrosion Control

A 5 MGD filtration plant at Rome, Ga., using alum and lime and adjusting pH with sodium carbonate, had red water trouble. Finding that water of 15 to 40 hardness but rich in soluble silicates affected pipe lining (at least 50 to 60 ppm silica necessary), they added 25 ppm sodium silicate to the effluent and decreased red water complaints 75%. Then found that by using sodium aluminate they reduced the alum dose by 1-3 and discontinued the sodium silicate, as the aluminate carried some silica.[A125]

Corrosion Of Iron Pipes

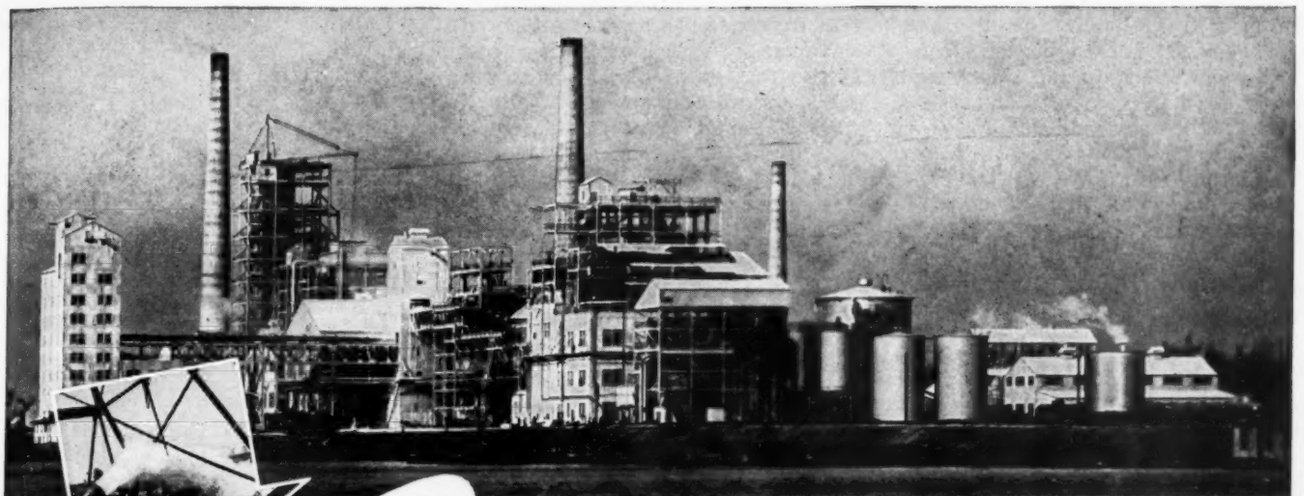
THIS is almost universal. The expense of lining with cement or tar enamel is justified; also use of reinforced concrete and cement-asbestos. For existing pipe, cleaning has its place, but must be repeated yearly if high coefficients are to be maintained. Chemical treatment doubtless prevents red water troubles, but the writer has found lime treatment of only limited value; he has had no experience with silicates. Of what value is a 100-year life of cast iron pipe if it loses 80% of its carrying capacity in 30 years.

Corrosion is favored by presence of oxygen, CO^2 (particularly in soft water), high pH, chlorides and velocity of turbulence; and is retarded by presence of buffer salts, considerable organic matter, high alkalinity (especially in the presence of normal calcium carbonate), and presence of rust or other protective coatings on the pipe surface.

Experiments on chemical coating are being conducted in a city using Lake Erie water, with facilities for inspecting the interiors of pipes, in connection with a program of main cleaning; lime meantime being added to maintain a pH of 7.89—from 27 to 60 lb. per mg. So far, these have demonstrated that corrosion can take place with production of red water or increase of iron content in the water; that lime treatment spreads a coating over old scale but corrosion continues within the tubercles; mains that have been mechanically cleaned corrode much more rapidly than those not cleaned; enough lime to produce a precipitate of calcium carbonate in the water delivered to the mains was not considered desirable and was not tried.[A125]

Making Reservoir With Shot-crete

A circular tank reservoir 50 ft. diameter and 30 ft. center height, with dished floor and domed roof, was built at Oakland, Md., using air-shot mortar, the walls being 6" thick, dome 5½" thick at circumference, 2½" at center, with 6 ft. rise. Vertical forms of boards on the outside, to which were fastened vertical and horizontal reinforcement. This was covered with 1" of gunite; then a second layer of horizontal reinforcement was covered with 1½" of gunite; followed by another 1½" coat of gunite and this by one ¾" thick, and



IT TAKES *Plenty of Water* TO MAKE FINE INDUSTRIAL CHEMICALS

THE FOUR gravel wall wells installed by the Layne Louisiana Company at the Lake Charles, Louisiana, Mathieson Alkali Plant have scored another Layne victory. After nearly five years of continuous 24 hour service, not even so much as the turn of a wrench has been required. Such records of efficiency are not unusual with Layne water-producing systems.

This company's well water requirements are furnished by four Layne Gravel Process Wells and four Layne High Efficiency pumping units, with a combined capacity of 6,500,000 gallons daily.

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Layne Wells and Pumps serve all kinds of Industries and Municipalities, not only in the United States, but throughout the world,—and from the smallest to the largest in each field. And wherever installed, they always win enthusiastic praise. For literature and basic facts on their excellent features, write LAYNE & BOWLER, INC., Dept. W, Memphis, Tenn.

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finally a ¼" flash coat. Then the forms were removed, surface of wall cleaned with compressed air and water, light wire mesh placed around it and covered with 1" of gunite, screeded and given a flash coat. Wire mesh sheets were used for dome reinforcement, two layers around the outer edge, and the gunite applied in rings of full thickness.[E40]

Accuracy of Water Meters

METERS are made that measure gasoline to within 0.1%, government meters measure beer with a 0.2% tolerance. Water meters with similar accuracy would be too expensive relative to the value of the liquid measured; the parts would have to be fitted with smaller clearances, which would apparently eliminate hard rubber because its coefficient of temperature expansion is 4 times that of bronze, and cause stoppages due to foreign particles, and shut off the supply entirely if the meter stuck. If there is any great improvement in domestic meters it probably will be brought about by designing one different from any now on the market.[B35*]

Applying Dry Chemicals to Reservoirs

LOS ANGELES, Calif., applies copper sulphate, alum, calcium hypochlorite, ammonium sulphate and activated carbon to its reservoirs in powdered form by means of a scattering device on a boat which consists of a blower operated by a 4 hp gasoline motor. Sugar-size activated carbon was distributed at the rate of 10 lb. per min. with a boat speed of 4 mi. per hr. In six hrs. 5½ tons of calcium hypochlorite was spread over a 90-acre reservoir, giving residuals of 0.5 to 1.0 ppm after 30 min. contact; previously 2 weeks was required to give an equivalent chlorine dose by standard chlorinators.[F55]

Activated Carbon In Water Treatment

ACTIVATED carbons are of three groups, only one of which is suitable for reducing odor in water. They are made from a wide variety of materials: "Norit" from coniferous woods and peat; "Cliffchar" from hardwood charcoal; "Darco" from lignite; "Magnechar" from wood charcoal; "Klearit" from creosote coke; "Nuchar" from wood pulp residues. The material is heated at 400°-500° C. to remove the volatile constituents, and the resulting carbon cleaned under oxidation conditions by use of steam, CO^2, chlorine or other gases under 800°-900° C. temperature. The exact mechanics of adsorption have never been completely and satisfactorily explained. It is affected by the specific surface of the adsorbent, the shape of its pores and quality of its surface, the nature of the treated liquid, the concentration of the substance in solution. It is an equilibrium phenomenon of reversible character, declines with rise in temperature, is dependent on the nature of the electrical charges of the adsorbent and the impurities to be adsorbed. There is a definite evolution of heat energy during adsorption. The phenol test is an arbitrary one and should be supplemented by the threshold odor test, but can detect inferior and unsuitable grades of carbon and serves as a convenient method of insuring delivery of a consistent quality of carbon.[A121]

To calculate the dose of a particular carbon for a particular water, it is necessary to know the amount of impurity to be removed, the amount to be left (complete removal is impossible; a hot odor threshold of 2 or less is recommended by Baylis), and a constant factor and exponent which depend on the nature of carbon, liquid treated and impurity removed, and are determined by test for each plant. By conducting tests with various carbon dosages and measuring the residual odors after treatment, these constants can be determined and, using a formula as explained by Mr. Helbig, curves plotted for service use in selecting the proper dosage and comparing carbons.[A122]

As to point of applying the carbon, Marsden Smith, from Richmond, Va., experiences, believes it should be applied directly to the filter in batches at intervals of say 24 hrs.; that if applied before coagulation, more than ten times as much carbon would be needed. This Baylis considers "almost impossible" and certainly applicable only in exceptional cases. Some of Smith's arguments are: If carbon is added with the coagulant, some is enveloped in the floc and withdrawn from service. Coagulation and settling itself removes some of the odor-producing impurities, which might have used some of the carbon if it had been added before. With the most thorough mixing, much of the odorous substance escapes contact with the carbon particles; but with a carbon film covering the filter, no such escape is possible. Also carbon is more efficient with neutral and acid solutions than with alkaline, and coagulation generally makes water more acid. Carbon can not stabilize sludge; it can absorb gases if putrefaction takes place—which it should not. Continuous feeding to coagulated water is simpler than batch feed, but requires more carbon and allows unsatisfactory water to pass the filter at the beginning of a run before the film has collected on the filter.[A123]

*See bibliography for Water Wheel in Public Works for September, 1938.

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c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, tecnnical article.

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121. *t.* Mechanics of Adsorption by Means of Activated Carbons. By M. M. Braidech. Pp. 1299-1319.
122. *t.* Taking the Guesswork Out of Activated Carbon Dosage. By W. A. Helbig. Pp. 1320-1324.
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124. National, Municipal and Privately Owned Water Supply Systems in Cuba. By J. A. Cosculluela. Pp. 1335-1341.
125. Corrosion Control—Studies and Operating Experiences: Engineering and Economic Aspects. By T. H. Wiggin. Effectiveness of Chemical Treatment. By G. D. Norcom. Calcium Carbonate Units and Corrosion Control. By I. M. Glace. Correcting Corrosivity of Zeolite Softened Waters. By D. E. Davis. Accomplishments with Chlorination. J. W. Ackerman. Use of Sodium Silicate in Corrosion Control at a Rayon Plant. By C. Alexander. Pp. 1342-1387.
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127. A New Development in Deep Well Pumping. By D. W. Conkling. Pp. 1399-1408.

D *The Surveyor*
August 26
28. Subsoil Water Supply Installations. By C. H. S. Tupholme. P. 239.

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September 8
38. Leakage Stopped with Grout Wall (Little Rock). Pp. 289-291.
39. A Water Plant in a Tank (Bristol, Conn.). Pp. 295-296.
40. Low Cost Water Storage. By D. E. Davis. Pp. 301-302.
41. Efficiency in Water Service (Indianapolis). By W. W. De Berard. Pp. 302-305.
September 15
42. Bituminous Enamel Bond Strength. By O. G. Goldman. Pp. 339-340.
September 22
43. Water, Sewers and Services, New York World's Fair. By L. B. Roberts. Pp. 375-377.

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August 31
56. Maintenance and Repair Methods (in Syracuse, N. Y.). By N. N. Wolpert. Pp. 1132-1138.
57. Importance of Ground Waters. By O. E. Meinzer. Pp. 1139-1143, 1157.
September 14
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59. Typical Costs of Softening Water in the Central West. By F. M. Veatch. Pp. 1210-1211.
60. Fixing a Meter Rate Schedule. By R. Newson. Pp. 1212-1214.
61. $10,000,000 for a Water Project (Los Angeles, Calif.). By W. W. Hurlbut. Pp. 1215-1218.
62. Operators Must Be Well Trained. Numerous Letters. Pp. 1219-1220, 1273.
63. Water for San Francisco via Submarine Lines. By N. A. Eckart. Pp. 1221-1226, 1276.

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September
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35. *p.* Methods of Meeting Peak Water Demands. By W. V. Weir. Pp. 847-851.
36. Effect of Silicate Treatment on Quality of Water. By J. R. Baylis. Pp. 855-858.

J *American City*
September
16. New Filtration Plant for Bristol, Conn. By T. R. Kendall. Pp. 53-56.
17. Color and Hardness Removed from St. Augustine Water. Pp. 69-72.

P *Public Works*
September
39. How Nashville Serves Suburban Customers. By R. L. Lawrence, Jr. Pp. 9-11.
40. Revamping an Old Filter. By D. Y. McDowell. P. 20.
41. Water Consumption Rates in American Cities. Pp. 24-25.

Cross Connections in Air Conditioning

In these days of expansion of the air-conditioning industry, many buildings installing this equipment find it desirable to provide their own water supply for cooling purposes. Also in some instances where shallow ground water is easily available, certain industries have installed their own water supply system for industrial and domestic use. It is usually the case, however, that these same buildings are also served by the municipal water supply. Some place within the building the two sources of supply are usually connected to the same plumbing system, with that supply not in use being separated from the plumbing with a gate valve, check valve, or a combination of both. This type of connection creates a physical cross connection which should not be permitted unless the private supply meets all sanitary standards as applied to the municipal system. Gate valves and check valves are not positive insurance against the passage of water through the same. We all know that some time or another valves of all types leak. When a safe water supply is separated from a non-potable supply by valves only, the latter may contaminate the former. Assuming that this condition exists in some building within your city, should the valve separating the two leak, water from the private supply could enter the distribution system when the static pressure of the unsafe supply exceeds that in the distribution system. Usually city pressure exceeds that of any private system under normal conditions. It is a fact, however, that there are times in practically every distribution system when a negative pressure may exist. During these times, there will be a flow of water from the private system to the public supply. Such conditions have resulted in contamination of many public water supplies with the consequent death toll from typhoid fever and other water-borne diseases.—*South Dakota State Board of Health.*

Water Consumption Data For Cities

A subscriber asks whether he can obtain a copy of the report on "Water Consumption in American Cities" by the U. S. Dept. of Commerce, referred to on p. 24 of our September issue. This, known as "Market Research Series No. 17," can be obtained by sending 10 cts. to the Department of Commerce, Washington, D. C.—an absurdly small price for information contained, which others of our subscribers may wish to obtain.

To Learn Upper Air Weather Conditions

THE U. S. Weather Bureau inaugurated a new program of extensive research into the stratosphere weather at Nashville, Tennessee; Fargo, North Dakota; Omaha, Nebraska; Oklahoma City, Oklahoma; Oakland, California; and Sault Ste. Marie, Michigan, during July, 1938. These cities were selected at strategic locations so that daily results will typify upper-air conditions of weather for the entire United States.

The key to upper-air weather is the Radio-Meteorograph, a light (approximately 2 pounds) radio transmitter sensitive to changes in air pressure, relative humidity and temperature, which is carried aloft to a height of 12 to 15 miles by a small hydrogen-inflated balloon. As it ascends (approximately 600 feet per minute) radio frequency signals which depend upon changes in the sensitive meteorological elements in the transmitter are received by an automatic radio recorder at the airport station.

These instruments will add greatly to the store of information used in general weather forecasts by the U. S. Weather Bureau and it is expected that such information of upper-air condi-

tions will be of great value to crop forecasting bureaus.

Due to the peculiar nature of this research and because of the technical skill required in the manufacture, calibration, and operation of this very delicate equipment, the U. S. Weather Bureau has adopted a novel method of cooperation with the manufacturer of the instruments. The successful bidder (in this case an old established firm of international reputation in the field of weather research) leases the transmitting and receiving equipment for a period of one year, during which time the responsibility of accurate calibration and perfect recording are placed on the manufacturer while the use and application of weather data becomes the problem and responsibility of the U. S. Weather Bureau.

This new Radio-Meteorograph program represents the culmination of research into the instrumentation methods which have taken nearly 10 years to bear fruit. Paralleling the efforts of the U. S. Weather Bureau to obtain an ideal instrument for upper-air weather investigations, the U. S. Navy in cooperation with the radio section of the U. S. Bureau of Standards and the technicians of Julien P. Friez & Sons laboratories effected the original model

The Radio-Meteorograph is used in exploring stratosphere weather conditions

of the instruments which are to be released. The U. S. Weather Bureau meteorologists will have full charge of the flights and will analyze and distribute the data in the form most useful to the public.

The balloon which carries the instruments aloft expands in the upper rarefied atmosphere and finally bursts, allowing them to float to earth on a parachute. They may reach the earth anywhere within a radius of 150 miles from the point of release. A reward of $1.00 is offered for the return of any instruments; for certain pre-selected serial numbers there is a reward of $5.00 or $20.00. The instrument case has complete instructions for return parcel post mailing, for which no postage is required. A simple procedure requires the restoration of two attached flaps which restores the transmitter case to a shipping carton. This carton is then delivered to the nearest post office without further wrapping and will be forwarded to Julien P. Friez & Sons who have leased the instruments to the Weather Bureau. The reward is sent immediately upon receipt. The finder has the double satisfaction of receiving pay for his effort in mailing the carton and in the knowledge that he has contributed to an outstanding scientific achievement.

The Sewerage Digest

A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

A High-Rate Trickling Filter

BEDFORD, IA., has just completed a treatment plant which includes a high-rate trickling filter (a Lakeside Engineering Corp. "Aero-filter") for a dry-weather flow of 105,000 gpd, or 250,000 wet weather. The filter tank is 24 ft. inside diameter, 8 ft. depth of rock. The distributing mechanism is a rotary disc powered by a 0.5 hp motor. A fan of 452 cfm capacity provides ventilation when the difference between air and sewage temperatures is insufficient to do so. The maximum rate of dosage will be 30 mgad. The makers guarantee the final effluent will not exceed 25 to 30 ppm of either B.O.D. or suspended solids, based on a maximum flow of 13,000 gph of raw sewage not exceeding 250 ppm B.O.D. Bids were received on both this and the old type filter, and that for this filter was 13.8% less than the others.[G35]

Sewage Disposal At Denver, Colo.

SEWAGE from 270,000 of Denver's population is discharged into the South Platte river, constituting an average of 21.5% of its flow—more than 97% on some days in dry season. All the river flow is used for irrigation, part of it on truck gardens. The State Board of Health has fixed the limit of pollution of the river water below the city at 40 ppm of 5-day B.O.D. The river never gives sufficient dilution to secure this unless the sewage is treated, and a double remedy is being provided—the sewage is given preliminary treatment, and additional diluting water is brought from the other side of the continental divide through a tunnel.

The treatment plant consists of mechanically cleaned bar screens with shredders; grit removal tanks with mechanical cleaning; preaeration tanks with mechanical skimmers, 15 min. detention, (preceded by application of chemicals when used); mixing basin with paddle-type agitators, 15-min. mixing; circular settling basins providing 2 hr. detention, 877 gal. per sq. ft. per day; magnetite filters 3″ thick, 2.68 to 4.0 gal. per sq. ft. per min.; sludge digesters, combined capacity 2 cu. ft. per cap. (inclusive of equivalent industrial load), 3 with Downes floating covers, one with a floating gas storage tank of 30,000 cu. ft. capacity, one tank for storage of sludge and supernatant; 12.5 acres of uncovered, undrained sand sludge drying beds, sludge removed by motor-driven belt conveyors. Ferric chloride will be manufactured at the plant. In June, 1938, this plant treated an average flow of 37.8 mgd; suspended solids, 178 ppm in raw sewage, 44 in settled, 27 in filtered; B.O.D., 137 ppm, 57 and 51 respectively, and 3 in the river above the plant and 22 below the plant.[L6]

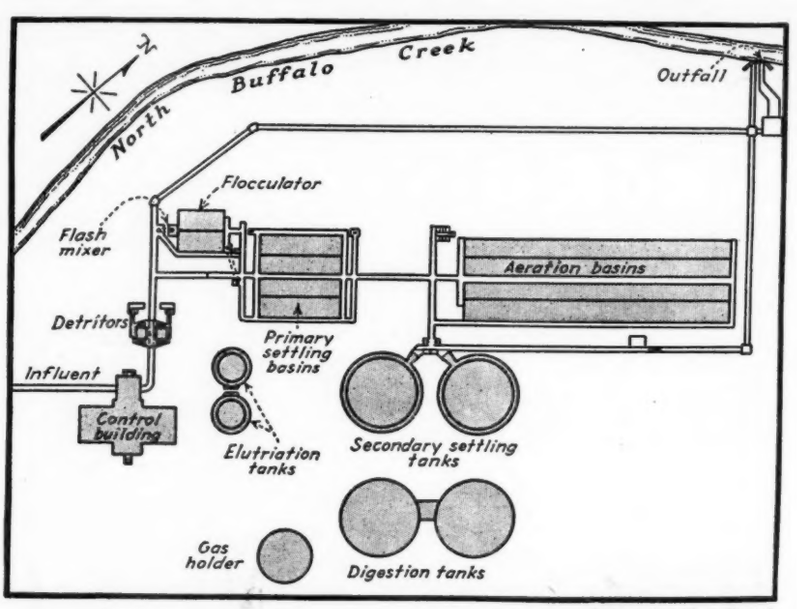
Treating Textile Wastes in Sewage

A PLANT is just going into service at Greensboro, N. C., for treating 6.5 mgd of which 2 mgd is textile wastes, equivalent to pollution from 20,000 people. The plant includes 2 comminutors; 2 detritors; 2 chemical mixing tanks with paddle wheel flocculators; 4 clarifiers; 4 aeration tanks; 2 final clarifiers; 2 digesters with floating covers; 2 elutriation tanks; a 30,000 cu. ft. gas holder; 2 manual chlorinators, 4 dry feeders, 2 transport dissolvers; 2 vacuum filters; 2 150 hp gas engines with a 100 kw generator; and 3 air blowers.

These various units are elaborately interconnected, permitting more than 12 different combinations; basins and digesters can be operated either in series or parallel; chlorine can be applied at the influent to the plant or the effluent discharge; and chlorine, iron, alum, carbon, etc. at the entrance to the flash mixer, or to the aeration or the final settling tanks; lime to the sewage after it has passed the comminutor. Scum from settling tanks can be pumped directly to digestion tanks. Textile wastes are discharged into lagoons, from these to sewers, a proportional flow device proportioning the discharge to sewers to the flow of domestic sewage, minimizing fluctuations in composition of sewage reaching the plant.[E25]

Land Fills for Refuse Disposal

NEW YORK CITY has developed a method of disposing of garbage and rubbish by dumping that practically eliminates nuisances, reclaims low, swampy areas, and costs but ¼ as much as incineration. A dragline excavator digs a trench in the soil 30 ft. wide, 4 to 6 ft. deep and about 200 ft. long along the foot of previous fill, piling the excavated soil for cover material. Collection vehicles dump their loads about 50 ft. back from edge of fill and bulldozer pushes it over into the trench;



Engineering News-Record

Layout of Greensboro treatment plant. More than a dozen different combinations of treatment possible.

"YES, 'INCOR' STANDS THE GAFF!"

A DOZEN bituminous coal mines drain into Mingo Creek near New Eagle, Pa., site of this concrete arch bridge. Exposed for over 8 years to high-sulphur-content creek water, 'Incor' concrete is as sound, its surface as dense, as the day forms were removed.

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its travelling back and forth compacting the fill. When the trench has been filled it is covered 9″ to 14″ deep with earth excavated from trench, and filling begun at another trench which has been dug meantime. The earth cover is applied every two or three days. Much of the success depends on compaction by bulldozer and trucks, which keeps out rats. Fires not allowed; hydrants and hose used to extinguish any accidental ones. A movable fence prevents blowing paper and serves as a screen. A creosote solution is sprayed by street flusher several times a day over working area of fill and roads leading to it. Roads on the fill are made with a 12″ base of old paving material, building debris, etc. from the refuse, covered with 3″ of ashes and kept surfaced with a grader.[E23]

Sewer Rentals For Sewerage Financing

OVER 30 states have passed enabling legislation permitting their municipalities to make direct charge for sewerage service. In most cases the rates are set to provide costs of operation and maintenance only. The cost of sewerage service for any producer is a function of both quantity and strength of sewage he produces—in one city of 50,000 population the O D of wastes from one industry equaled that of domestic sewage from 300,000. Charges are made on basis of (a) water consumption (meter readings); (b) type and size of building (flat rate); (c) number and type of fixtures. Basis (a) is most common and equitable, but should be modified to allow for metered water that does not enter the sewer, private supplies that do, areas outside the municipality (addition to cover fixed charges not included in rates), and varying strengths of industrial wastes.[A120]

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The articles in each magazine are numbered continuously throughout the year, beginning with our January issue.

c. Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

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August 26
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September 9
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September 1
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September 8
24. Tools for Sanitary Research. By G. M. Fair and E. W. Moore. Pp. 297-300.
September 15
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September 22
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September
33. Developing a Sewer Rental Plan. By R. A. Allton. Pp. 852-854.
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35. High-Rate Trickling Filter at Bedford, Ia. By C. M. Stanley. Pp. 891-894.

H *Municipal Sanitation*
September
54. River Flushing Sweeps Industrial Sludge from Scoured Holes. By J. B. Hawley. Pp. 424-427.
55. Maintenance of Sewage and Sludge Pumps. By L. M. Johnson. Pp. 428-430.
56. $15,000,000 Buffalo Project Protects International Waters. By P. Hansen. Pp. 433-435, 438-440, 442, 444.

J *American City*
September
23. Chemical Coagulation of Sewage at Danville, Ill. By P. Hansen. Pp. 59-61.
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September
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7. West Virginia's Rural Sanitation Program. By H. K. Gidley. Pp. 599-600.
8. Status of Sewage Disposal in Western States. By D. E. Kepner. Pp. 608-610.

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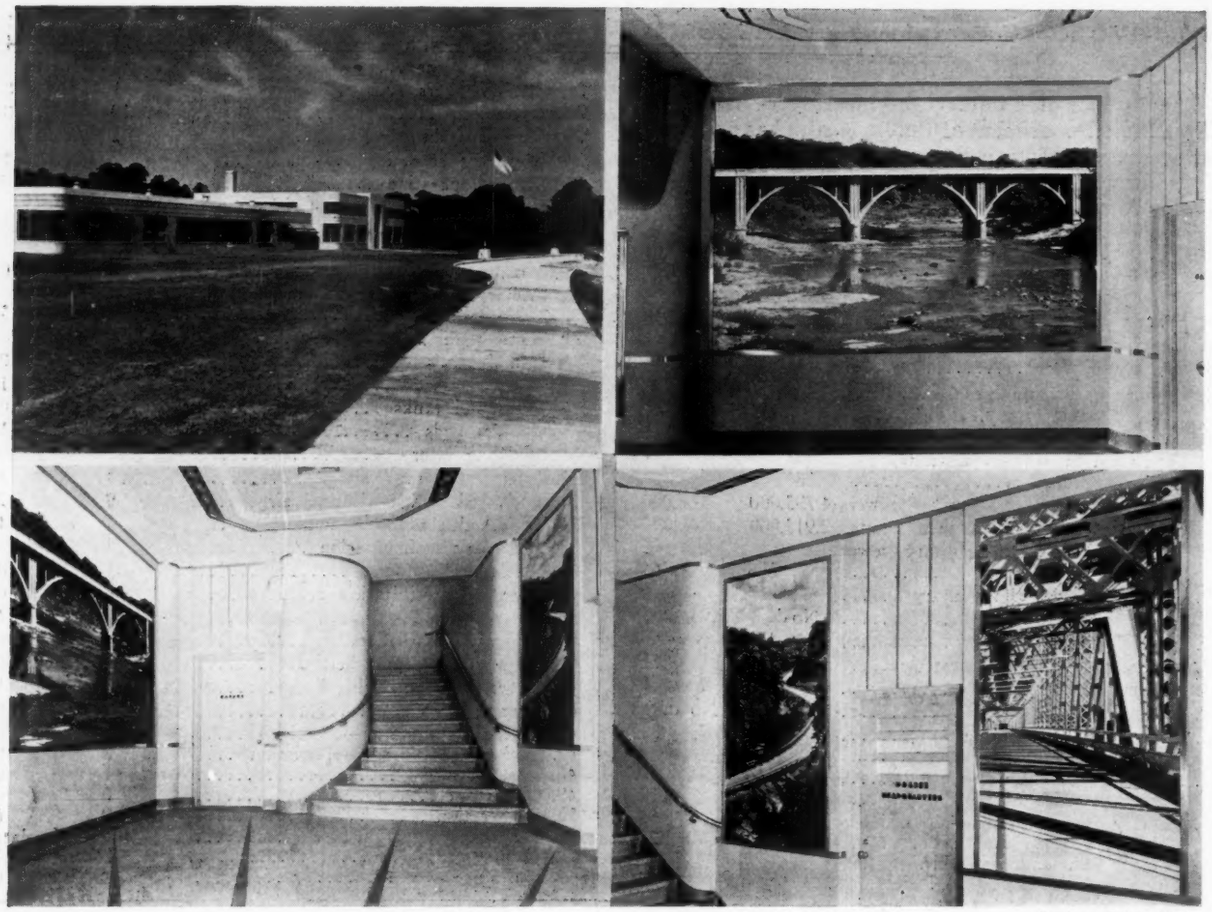
September
37. A Year's Experience with Chemical Precipitation. By J. W. Hood. Pp. 15-16.
38. The Operation of Sewage Treatment Plants. Units and Methods of Measurement. Composition of Sewage. Tests and How to Make Them. Grit Chambers and Screens. Sedimentation Tanks. Sludge Digestion. Imhoff Tanks. Disposal of Sludge. Trickling Filters. Contact Beds and Sand Filters. Chemical Treatment and Coagulation. Disinfection of Sewage. Vacuum Filters and Centrifuges. Pre-aeration. By W. A. Hardenbergh. Pp. 39-64.

An Inventory of Sewage Disposal In California

The Bureau of Sanitary Engineering of the California State Department of Public Health has prepared an inventory of sewage disposal plants in California as of January 1, 1938. The data have been prepared in tabular form, as follows:

	Incorporated places, sanitary and utility districts, etc.	*Institutions and others (not complete)*
1. Year of data	Jan.1,1938	Jan.1,1938
2. Incorporated places	282	
3. Sanitary district	57	
4. Number of communities served by public water supply, approx.	316	64
5. Total urban population	4,910,000	
6. Population in sanitary districts, etc. (approx.)	283,000	
7. Population served by sanitary sewers	4,793,000	60,000
8. Population served by treatment plants.	2,913,000	60,000
9. Number of separate sanitary sewer systems	286	64
10. Combined storm and sanitary	17	0
11. Storm sewers only	No data	No data
12. Sewage treatment plants	177	60
13. Privately owned sewer systems	1	31
14. Systems charging rentals	0	0
15. Industrial waste plants	No data	No data
16. Sewer farms—no disinfection	90	32
Sewer farms—with disinfection	9	6
17. Screening—no disinfection	6	0
Screenings—with disinfection	2	0
18. Primary sedimentation—no disinfection	143	23
Primary sedimentation—with disinfection	46	14
19. Oxidation—no disinfection	20	21
Oxidation—with disinfection	21	4
20. Coarse screens	No data	No data
21. Grit chambers	1	0
22. Fine screens	10	0
23. Screenings shredders	2	0
24. Incinerate screenings	2	0
25. Grease separation	2	0
26. Primary sedimentation — without coagulant	166	60
27. Primary sedimentation — with coagulant	0	0
28. Primary sedimentation — mechanical sludge removal	34	3
29. Septic tanks	54	24
30. Imhoff tanks	74	30
31. Doten tanks	1	1
32. Dortmund tanks	0	0
33. Contact beds	1	1
34. Trickling filters	31	19
35. Intermittent sand filters	24	4
36. Activated sludge—diffused air	9	2
37. Activated sludge—mechanical	1	4
38. Secondary sedimentation	21	15
39. Mechanical strainers	1	0
40. Chemical precipitation	0	0
41. Chlorination	30	14
42. Separate sludge digestion	48	8
43. Open sludge drying beds	103	60
44. Covered sludge drying beds	0	1
45. Sewage lagoons	2	0
46. Sludge conditioning—chemicals	1	0
47. Sludge conditioning—elutriation	0	0
48. Vacuum filters	1	0
49. Centrifuge	0	0
50. Incineration	0	0
51. Fertilizer production or use	107	No data
52. Gas for heat	14	1
53. Gas for power	4	0



Kaufman-Fabry Photo

Headquarters for more and better highways. Top left, the new district highway office of State of Illinois near East St. Louis. Lower left, the lobby with photomural of concrete viaduct. Right, upper and lower views are of other photomurals of highway scenes. Highways architect Ralph C. Harris designed the building.

Highway Construction

Australian Experiences With Road-Mix Seals

In his annual report for 1936-1937, L. F. Loder, chief engineer for Victoria, Australia, reported on his experiences with road-mix seals, as follows:

When road-mix seals were first tried, the binder content was based on the binder content generally used in the normal type of seal being carried out at that time, as the object was to achieve an improvement in riding surface. The possibilities of achieving a non-skid and anti-glare type of pavement were not at that time appreciated.

These early road-mix seals, while achieving the initial objective, were frequently "fat" in parts, and experiments were then carried out to determine what reduction in binder was possible to get a more uniform texture and a non-skid and anti-glare surface. The work being done was largely ½ in. loose thickness only, on old rather "fat" seal coats, in which a very small amount of the applied binder would apparently be used as a tack coat. During the 1936-37 season, when working conditions were particularly unfavorable, a certain amount of ravelling was experienced.

From an investigation of a large number of road-mix seals, it is felt that an increase in the amount of binder is desirable, and can be safely made without affecting the non-skid surface. This will provide a margin to allow for poor weather conditions, type, condition, or inefficient operation of mixer, or dusty aggregate. In addition, specific instructions will be isued to provide for an increase in the total binder when the kerosene flux is increased under cold conditions, thus retaining the approximately correct proportion of effective binder in the mix. It is felt also that, provided the amount of binder does not cause a "fat" surface, an increase, generally speaking, will tend towards increasing the life of the seal.

A comparison has also been made between successful plant mixes using cold cut-backs, and the proposed rates, assuming that approximately .05 gallon per sq. yd. is used as a tack coat, and on this asumption the rates of application given below are in reasonable agreement with the plant mix work, although they have been

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 62-65

based originally on the results of the field investigations.

RATES OF APPLICATION

Cut-back Bit. Tar. Kero.	Loose Thickness of Aggregate ½ in.	¾ in.	1 in.
100 — 26 — 15	0.24	0.29	0.36
100 — 26 — 20	0.25	0.30	0.37
100 — 26 — 25	0.26	0.31	0.38
100 — 26 — 30	0.27	0.32	0.39

In addition, the small road-mix seal machines most commonly used are being de-designed. Curved blades with freer movement are being provided, and other detail improvements made.

When the binder is being applied, in every case, 0.10 gallon per sq. yd. will be sprayed on to the pavement before the spreading of the aggregate and the balance sprayed on to the aggregate after it has been spread and levelled with the broom drag.

The standard cut-back for use under average summer conditions will have a viscosity of from nine to 14 poises at 122° F., the fluxing being 100-26-20 (85/100 penetration bitumen, dehydrated tar and power kerosene).

To meet the prevailing weather conditions, the following variations from this standard material are to be used:—

Very hot weather	100-26-100
Cold summer weather—	
First load for the day	100-26-30
Second and last for the day or for any other intermediate loads as found necessary	100-26-25

Surfacing Steep Gradients With Concrete

In surfacing a street having a gradient of 8% to 16%, in Chingford, England, a 2-inch dry granite was vibrated into a base of 4-in. ballast concrete. S. J. Hellier is engineer and surveyor to the Chingford Urban District Council and the work was described briefly in *Highways and Bridges* as follows:

The concrete was composed of four parts of washed river ballast, to which was added 1½ parts of washed river sand mixed semi-dry and wheeled and spread to a thickness of 4 in. Two-inch cubical Guernsey granite was then spread dry one stone thick over the concrete, and an electrically vibrated tamper was passed over the surface. Owing to the coarseness of the sand used, it was found necessary to spread a thin coat of cement mortar composed of three parts of sand to one part of cement over the surface, and the whole was then consolidated to a thickness of 4 in. by means of the vibrated tamper, the mortar being brushed under the tamper as it moved along, and care being taken to see that every piece of granite was well bedded in. As soon as the initial set had taken place, the concrete was brushed over lightly with stiff brooms, so that the top of the granite was standing clear of mortar. The bays were 50 ft. long by 9 ft. wide, and expansion joints were placed at each end of the bays. The bays were opened to traffic within a few hours of completion, and it speaks well for the method that a loaded lorry (total weight 7 tons) went over two bays within an hour of completon without disturbing a stone; also a horse drawing a pneumatic-tired milk float trottled down the steepest gradients without any signs of slipping.

A test slab constructed in the bay when sent for laboratory tests showed a strength of 5,160 pounds per square inch.

Highway Research and Testing in Indiana

UNDER the direction of Prof. W. K. Hatt of Purdue University, projects in highway research are being carried on in cooperation with the Indiana State Highway Commission. These projects, which are reported in some detail in the Bulletin of the ASME, include compression tests of soils, frost heaving, bitumens and abrasion.

R. I. Mayo is in charge of the compression tests. The shearing test is a fundamental one in measurements of stability; but the compression test, widely used and standardized for many materials, is in reality a test for shearing strength if failure is attended by development of a cone which indicates shear action on internal planes. An attempt is being made to develop a method of compaction of soil mixtures in a cylindrical mold such that uniform compaction vertically and sidewise may result and typical cones may appear in a specimen tested in compression.

Several methods of compaction have been tried as follows:

1. Compaction in layers by Proctor hammer.
2. Number 1 procedure plus rodding with ½ in. steel rod.
3. Number 1 procedure plus rodding by a ⅛ in. wire.
4. Compaction by steady pressure in testing machine, either from one end of specimen or from both ends.

The latter yields more uniform specimens, and agrees with density values obtained in other tests.

After having been molded, soil mixtures were submitted to a compression test with measurement of elastic limit, modulus of elacticity, and ultimate strength.

Under continuous loading, the material (60 per cent sand, 40 per cent clay) showed an elastic behavior up to 0.6 of the ultimate strength when rodded, and a clearly defined modulus of elasticity. This elastic limit varied with the method of compaction, but has been up to 230 lb. per sq. in., with a modulus of elasticity of 80,000 lb. per sq. in. for rodded compaction with a wire; and 160 lb. per sq. in. elastic limit, 260 lb. per sq. in. ultimate strength rodded with ½ in. rod; and 100 lb. per sq. in. elastic limit, and 287 lb. per sq. in. ultimate strength when compressed in the testing machine. This investigation will be continued and an attempt will be made to correlate compressive strength with routine tests and with service in the field.

The study of heaving of roads as related to frost action is in charge of H. F. Winn. Freezing action proceeds downward from a road surface and will meet, in capillary soils, water coming up from below, with the result that ice-lenses are formed within the road bed. With such an open system, the ice-lenses increase in size with the continued supply of capillary water from below. The road surface then heaves. The laboratory has developed a room with controlled temperature and with provisions for duplicating these actions of nature. Soil mixtures with several stabilizing admixtures are tested to determine, with each admixture, what amount of increase of height of the specimens may be prevented. The existence of such ice-lenses is visible. These laboratory results are compared with the behavior of a test road containing the same stabilizing admixtures. The test road, subjected only to changes of climate, has been under observation since November, 1937. It also serves to indicate the predictive value of routine tests of soils, such as freezing and thawing, wetting and drying, etc.

In treatment of old surfaces with mixtures of bitumen and rather fine aggregate, the material is rolled with

When writing, we will appreciate your mentioning PUBLIC WORKS.

a 10-ton or a 5-ton roller, resulting in a degradation of the aggregate. Whether one of the standard abrasion tests, for instance the so-called Los Angeles rattler test, will select the aggregate most suitable for such service, is a matter of doubt. To develop information on this point, a section of a rigid road (concrete), and also a section of a semi-rigid road (oil mat), have been built. All the aggregates commonly used in Indiana will be in turn spread on these roads and subjected to the action of rollers. Sieving before and after will determine the loss of aggregate. Identical samples will be subjected to the Los Angeles rattler test. This work is in charge of T. E. Shelburne.

Observations already made on such surface treated roads that have been in service for a year, show a disintegration shortly after rolling, and a continual disintegration with duration of service under traffic.

A bulletin reporting research upon the adhesion of several bitumens to typical aggregates is being prepared. The laboratory is now engaged in a study of Kentucky rock asphalt from production at the plants to use in road construction. O. R. Tyler is in charge.

Concrete Road Construction by the Holter System

In building concrete roads by the Holter system, which is used extensively in Norway, the procedure is as follows: The roadbed is graded and prepared; steel forms are then staked in place firmly enough to carry the roadmaking machinery. A layer of sand from half an inch to an inch thick is spread on the subgrade. The spreader then travels over the forms. This is in two parts; the first unit mixes and spreads mortar, the second distributes broken stone or aggregate to the desired depth on top of the mortar.

After these materials have been spread, the road is traversed with a harrow roller or a sheepsfoot roller, which moves forward and backward. The action of this equipment presses the stone into the underlying mortar, which is worked to the surface. After about half an hour of such rolling-harrowing, a thoroughly mixed concrete of very low water content is produced.

If transverse joints are to be used, they are set at this stage by constructing grooves in the wet concrete and inserting the joints. The concrete is then rolled to compress the concrete and expel the air. It is then worked on by another machine, consisting of a transverse tamper foliowed by a longitudinal tamper, the effect of which is to make the concrete, which is very dry, sufficiently plastic for float finishing. After this stage of treatment, the concree is so hard that there is no flow, which is important on grades or superelevated curves.

Norway requires that the maximum surface irregularity be one-fourth inch in 13 ft. Tests on a number of concrete roads have shown void content of tamped concrete roads to average 10.73%, vibrated roads 14.45% and Holter type roads 8.06%. Average thicknesses for Holter and vibrated roads are 5.13 ins. and for tamped roads, 6 ins. at the center and 7.13 to 8.63 at the sides. Reinforcement is not used with the Holter concrete.

Molasses for Road Surfacing

Research in India is said to have succeeded in converting molasses into an insoluble resinous product, well adapted to road surfacing purposes. The resulting product is stated to be insoluble in water, impervious to heat action and to give good results even under heavy traffic. The work has been carried on by the Imperial Institute of Sugar Technology, Cawnpore.

Keeping Up With New Equipment

Dorr Company to Market Automatic Magnetite Filter

The Dorr Company, Inc., has acquired from Filtration Equipment Corporation exclusive sales rights in the United States to the Automatic Magnetite Filter. This unit, although marketed and serviced from now on by the Sanitary Engineering Division of The Dorr Company, will continue to be designed and manufactured by Filtration Equipment Corporation.

The Automatic Magnetite Filter improves the quality and uniformity of the effluent from sedimentation tanks by straining out practically all of the settleable solids left in the sewage after the sedimentation period. A reduction in B.O.D. is likewise accomplished in direct relation to the suspended solids caught by the filter. It is also applicable to water supply and treatment of trade wastes.

The filter bed of crushed and graded magnetite iron ore may be installed in the sedimentation tank itself, concentric with and parallel to the overflow launder or it may be placed in a separate structure. Washing of the bed is accomplished automatically by a traveling cleaner which passes slowly over the bed and agitates the sand magnetically while occluded solids are being washed out.

The Automatic Magnetite Filter is especially adapted to installation around the periphery of round Dorr Clarifiers, as the motor that drives the clarifier mechanism may also be used to drive the traveling cleaner of the filter.

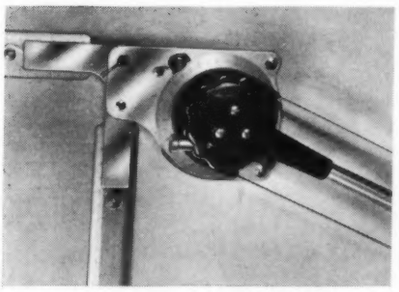
For Better Bituminous Road Construction

A spreader and finishing machine has been announced by Shunk Mfg. Co., Bucyrus, O. This is adapted for laying or spreading bituminous roads surfaces —hot or cold-mix, plant-mix, and all kinds of base courses.

There are a number of interesting and valuable features on this spreader. The rear drive or tread runs on the newly laid surface so that irregularities are not reproduced in the pavement surface. Scarifying of the old surface and filling of depressions, the makers say, is not needed, as all such irregularities are taken out by the process of spreading and compacting.

Material may be laid in most any desired thickness, from a thin mat up to 6 or more inches; or it will lay one to three inches thick on one side, and three to six inches or more on the other. The machine lays to a straight line, so that a second lane joins to the first without a visible joint after rolling.

The capacity is 1,000 to 1,200 tons per day; widths from 6 to 10 ft., variable, can be laid; and of course it lays to desired grade. The manufacturer has an excellent 6-page descriptive bulletin which will be sent on request.



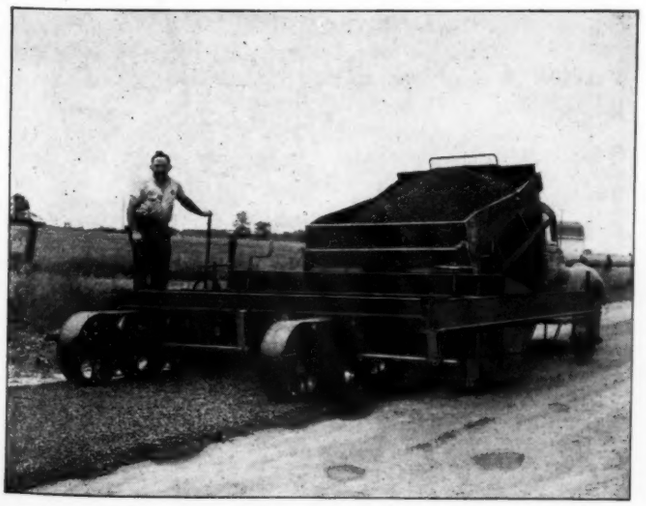
Bruning's "Drafter" for civil engineers, map draftsmen and navigators.

Making the Engineer's Drafting Work Easier

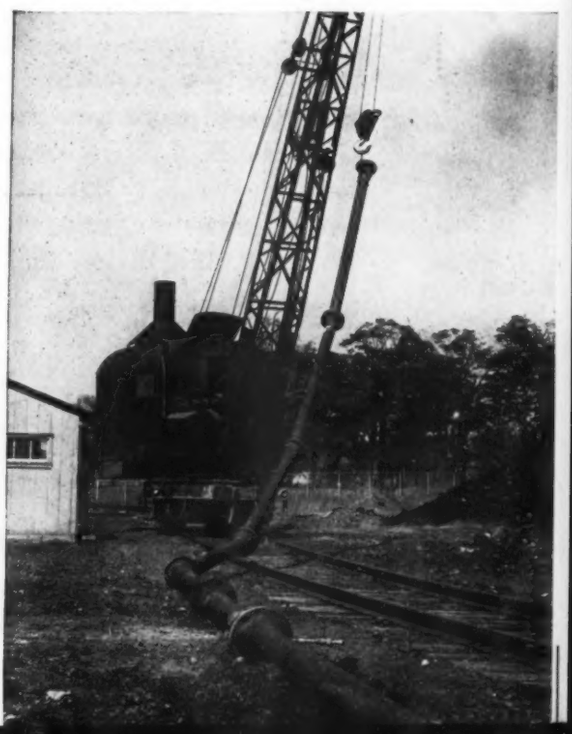
The Charles Bruning Co., 100 Reade St., N. Y., announces a "Civil Engineer's Drafter," especially designed for the use of map draftsmen and navigators. This drafter provides a quick, accurate method of plotting maps directly from the surveyor's notes. The full circle protractor, 4⅞" in diameter, is graduated each one-half degree and numbered with two rows of figures. The inner row of figures for azimuth readings is numbered 0° to 360°, while the outer row is numbered in each quadrant, from 0° to 90°. This machine is provided with a micrometer adjustment screw. Double vernier reads to single minutes and is flush with the protractor —no parallax. The large magnifier rotates with the vernier and is always in position for reading.

A counter-balanced drafter with all the features of the standard drafter including "Touch Control" is also available for use on vertical boards. This new machine eliminates the track pulleys and ordinary weights heretofore used in this type machine. Information on request.

This shows the flexibility of the new Usiflex joint of the U. S. Pipe & Foundry Co. Later the pipe in this same position was subjected to 300 lbs. pressure without leaking. Excellent booklet available.



Left: The new Shunk spreader and finishing machine for bituminous surfacing.



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Marmon-Herrington Marsh Buggy

The Marsh Buggy

This is a four-wheel drive unit, powered by a Ford motor and mounted on extra large tires. It was developed by Marmon-Herrington Co., Indianapolis, Ind., primarily for oil-field work, for the transportation of geologists, oil scouts and operators through swamp and sand-locked territory. The manfacturers also state it is adapted to road-building and pipe line work in making surveys through marshy and swampy country, over streams, through deep sand and on steep grades. The manufacturers will send fuller information on request.

Heil Garbage Collecting Units for New York City

These four large capacity dump units are part of a fleet of more than 200 trucks equipped with fully enclosed, automatic loading garbage collecting bodies manufactured by the Heil Co., Milwaukee, and recently delivered to the City of New York. This is the second time within three years that Heil has secured a large order for this type of equipment from the New York Sanitation Department.

Rubbish is loaded into the receiving hopper at the rear of the body and is carried by an endless chain conveyor up into the 22 cubic-yard body. An overload clutch stops the conveyor in case of an obstruction. To dump the contents of the body, hydraulically operated jacks raise the tailgate and the Heil twin cylinder telescopic hoist elevates the body to a 55 degree angle. In addition to the loading conveyor, the bodies are equipped with side loading doors near the front. All controls for operating the hoist, conveyor, tailgate and snow plow are located in the cab.

The bodies are specially designed units of 22 cubic yard capacity, almost 18 feet long and eight feet wide. Gross weight of the vehicle is 37,000 pounds, and between 65 and 70 per cent of the weight is carried on the rear wheels. The Model UT Autocar which propels the unit has a 173 inch wheelbase, and is equipped with air brakes and 11.25 x 20 dual rear tires.

Bigger and Better Rubber Linings

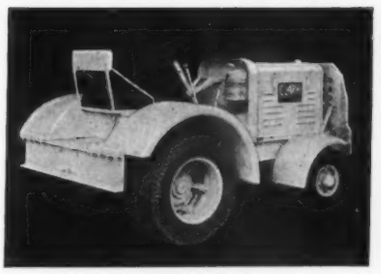
The Goodyear Tire & Rubber Co. has installed at its No. 3 plant in Akron, O., a heater that is big enough to vulcanize Plioweld rubber linings onto most anything. This heater or oven is 45 ft. long, and 15 ft. in diameter; railroad tracks run into it; and it is equipped to withstand 75 pounds steam pressure. In the Plioweld process, a protective layer of rubber is applied to the cemented surface of the metal to be protected and then vulvanized, which completes the bonding of the rubber and the steel.

A Hole Digger

There isn't much romantic about a hole digger, but it may have an important financial aspect. A new type machine has been devised by the Buda Co., Harvey, Ill., which will manufacture holes up to 30 ins. in diameter and 24 ft. deep—and of course smaller and shallower holes. Among its uses are drilling holes for pole lines, for fence posts, guard rail fencing, building foundations, soil testing, blasting, etc. It works in shale or hardpan, clay or swamp, and frozen ground doesn't hardly slow it down. Mounted in trailer, tractor or truck.

Buda-Hubron Hole-Maker

This drill, called the Buda-Hubron, on a job in Chicago drilled 120 holes, 24 ins. diameter, to a depth of 20 ft., through clay and sand. These holes were for cast-in-place foundations, and went down on either side of a large sewer, which required a lot of moving of the truck-mounted unit. But all holes were sunk in 5 days, working three shifts a day. In one 24-hour shift, 42 holes were sunk, and the fastest time on any one hole was 12 minutes.



A new small but powerful tractor—the Clark—is efficient for highway and general utility work. Information from R. Marshall, 6553 Woodward Ave., Detroit, Mich.

New FWD Trucks

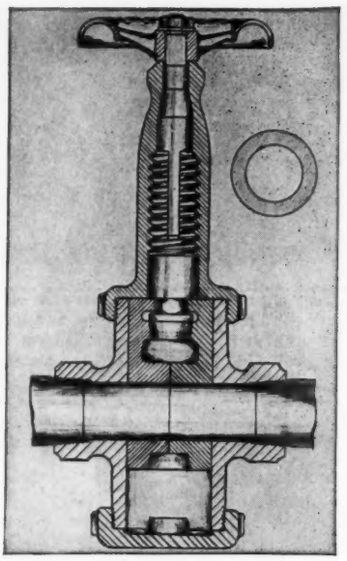
The new models CU and CUA, rated capacity 3 to 4 tons and gross vehicle weight 20,000 lbs., are announced by The Four Wheel Drive Auto Co., Clintonville, Wisc. Developing 96 BHP, and 280 lbs. ft. of torque, these two FWD models are designed for mounting a wide variety of auxiliary equipment and bodies.

Also included among the mechanical features of the Models CU and CUA are: 5-speed transmission; a midship sliding jaw clutch type on the CU and a sliding gear unit type on the CUA; 14" single plate clutch; gear ratios of 7.13:1 standard, and 6.72:1, and 8.84:1 optional; single reduction, bevel gear type, full floating axles, with split type housing, both front and rear; 9.75x20 tires, singles front and rear, duals optional at extra cost; 71" tread; 150" wheelbase.

To permit ready installation of various control valves for the operation of the plows, underbody scrapers and various other hydraulically controlled equipment, the instrument panel has been offset to the left of the cab, and is readily visible to the operator through the large steering wheel. By this panel installation, the control valves may be mounted on the dash, under the cowl with only the control handles protruding into the cab, and providing a clear space for the knees and feet of the operator.

Heil Garbage Collection Bodies

New Model FWD Truck



Monat Packingless Valve.

A Packing-Less Valve

The Monat Valve and Forge Company, Pittsburgh, Pa., has developed a packless, cylindrical gate valve, suitable for both high and low pressures and temperatures.

While this "stream-flow" valve retains the salient construction features of both gate and plug valves, there are no cavities and friction is eliminated. It is available in sizes ranging from ½" to 8" in the standard metals. Also in special metals for corrosive liquids and gases.

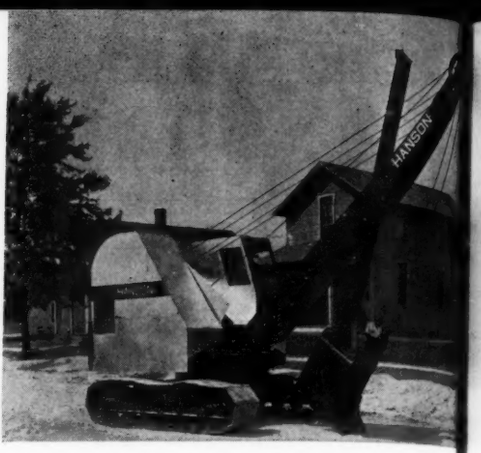
The body of this new valve carries a cylindrical bore, at right angles to the line of flow. A cylindrical gate is moved up and down by means of a screw in the valve bonnet, and is prevented from turning by a key in the cylindrical bore. The run of the valve conforms in shape and size to that of the pipe—namely that it is circular.

No packing is required. The only operating part in the line of flow is the gate itself. A cap on the bottom of the body and the removable bonnet permit cleaning the valve while it is in the line.

A New ⅜-Yard Shovel

The Hanson Excavator Works, the crane and shovel division of the Hanson Clutch and Machinery Company of Tiffin, Ohio, have in production a new ⅜-yard shovel, crane, clamshell, dragline, pile driver and/or trench-hoe, called the "Comet." This is a full revolving machine mounted on an electric welded steel lower base or frame. The crawlers are oversize in comparison to the weight of the machine, giving ease of travel and operation.

All shafts on the upper decks are mounted on life-time roller bearings that do not require grease or oil at any time and/or Timken taper roller bearings requiring lubrication but once weekly (24 of such bearings). Each shaft is so mounted that the removal of one may be made without disturbing any other. All clutches, which are Lockheed-Hanson patented expansion double shoe type, are independent hydraulic controlled (there is an automatic fluid control for each clutch and brake) giving easy control in running. The shoes in the clutches and brakes may be relined without dismantling the shafts.



New Hanson ⅜-yd. Shovel.

The "Comet" weighs approximately 20,000 lbs. It is also available truck-mounted, weighing 12,500 lbs. in ⅜-yd. sizes, fully convertible.

1939 ARBA and Highway Exhibit

The 1939 American Road Builders' Association Convention and Highway Exhibit will be held in San Francisco during the early part of March, 1939, according to C. D. Macpherson, member of the board of directors and executive committee of the manufacturers' division of the A. R. B. A., National Press Building, Washington, D. C.

Georgia Water and Sewerage School

The 7th annual Georgia Water and Sewerage School will be held in Atlanta, Ga., Nov. 16-19, under the joint direction of the Georgia Water and Sewerage Plant Operators Ass'n, the Georgia School of Technology and the Georgia Department of Public Health.

The course will include laboratory work at the Clayton (Atlanta) sewage treatment plant; water laboratory work; chemistry of water treatment; flow through pipes; hydrants; meters; new equipment; sterilization; water purification, including iron and manganese removal, corrosion, use of activated carbon, coagulation and softening; pH control; swimming pools, and plant inspections.

This course has been a most successful one. Last year 204 attended. For information write W. H. Weir, ass't director of Sanitary Engineering, State Board of Health, Atlanta, Ga.

Asphalt Institute Meeting Date Changed

The 12th National Asphalt Conference will be held in Los Angeles, Calif., the week of February 27, instead of February 20, as previously announced.

These Will Be Sent on Request

"1-Hour Oxygen Breathing Apparatus" is a 4-page folder that illustrates and describes new apparatus designed for complete respiratory protection in atmospheres containing concentrations of gas too high to permit the use of canister-type masks, or where oxygen content is low. Mine Safety Appliances Co., Pittsburgh, Pa.

"For Your Weighty Problems" is a new folder, 6 pages, describing the advantages of lifting and carrying weights and heavy loads with tractor power. R. G. LeTourneau, Inc., Peoria, Ill., or Stockton, Calif.

Goulds Pumps, Inc. Seneca Falls, N. Y. have a bulletin describing their new line of Fig. 3390 Centrifugal Pumps. These pumps are two-stage with approved hydraulically balanced impellers for heads up to 1000 feet. Bulletin gives complete description.

Snow Plows and Equipment.—Austin-Western Road Machinery Co., Aurora, Ill., has issued an excellent and instructive 8-page booklet describing their one-way and V plows, wings and push frames.

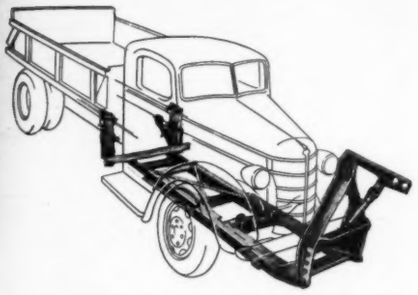
Airport Building.—An 8-page booklet telling how every community may enjoy the benefits of first class airport facilities. Profusely illustrated with actual job pictures; explains how cities, government agencies, and private companies can afford to "stay on the Air Map." R. G. LeTourneau, Inc., Peoria, Ill., or Stockton, California.

Air Compressors.—Sullivan Machinery Co., Michigan City, Ind., have published a 20-page bulletin on their "Unitair" compressors, both stationary and semi-portable. Capacities range from 107 to 435 cubic feet per minute.

All-Wheel Drive Trucks for Snow Removal.—Folder issued by Marmom-Herrington Co., Inc., Indianapolis, Ind., tells of the advantages of using powerful, all-wheel drive trucks for plowing snow.

Caterpillar Tractor. — Capacities, specifications and mechanical features of the largest "Caterpillar" diesel tractor have been grouped together in a new booklet, Form 4876, just issued by the company. Two colors, many action views. Caterpillar Tractor Co., Peoria, Ill.

Highway Lighting.—An 8-page illustrated booklet which gives facts concerning accidents, general information on highway lighting and descriptive material regarding sodium highway luminaires and sodium vapor lamps. Ask for leaflet 60-070. Westinghouse Electric & Mfg. Co., Lighting Division, Cleveland, Ohio.

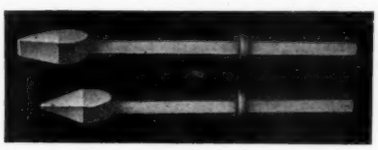


This shows how the Austin-Western snow plow frame is attached to a truck. This is a simple arrangement, requiring only a short time to install. Both V or one-way plows fit this attachment so that either can be used. Changeover requires only a few moments. Snow booklet on request.

New Type Concrete Buster

The Sullivan Machinery Company has recently developed and marketed a new type of steel known as "Arropoint," designed for use with pneumatic concrete busters.

The outstanding feature of the new steel is an upset end which provides a wider, more efficient point angle and locates more stock at the working end of

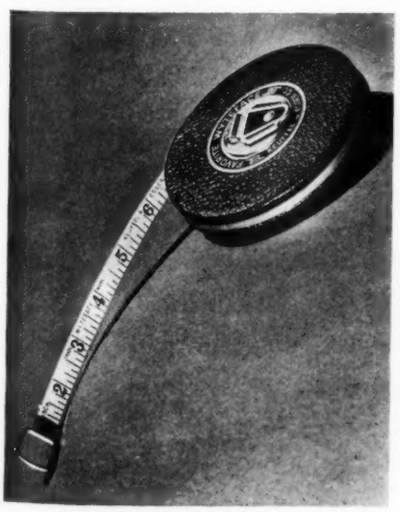


Arropoints

the steel to provide greater resistance to drilling and breakage. It is claimed that Arropoint steels last longer, stay sharp longer, break concrete faster and are easier on the operator than conventional steels. They are available in all standard buster steel sizes and with both pick (moil) points and narrow chisels.

Easier on the Engineer's Eyes

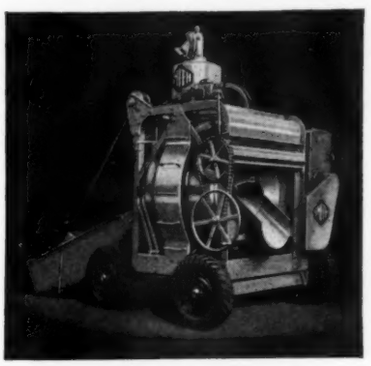
A new Wyteface steel tape designed for general use is announced by Keuffel & Esser Co., Hoboken, New Jersey. It has black graduations on a crack proof white surface, easy to read, even in poor light. The white surface is firmly bonded to the steel, protecting it from rust and corrosion and greatly increasing the useful life of the line.



K & E Wyteface Tape

New Smith 14-S Mixer

The T. L. Smith Company, Milwaukee, Wis., has a brand new 14-S Non-Tilt Mixer in four wheel, end or side discharge models. The makers state the new machine has refinements to speed



Smith 14-S Concrete Mixer

up loading, mixing and discharging. It has an "end-to-center" mixing action. The drum is unusually narrow with an extra large diameter and bigger drum openings. The complete machine is of sturdy all steel construction, compact and light in weight.

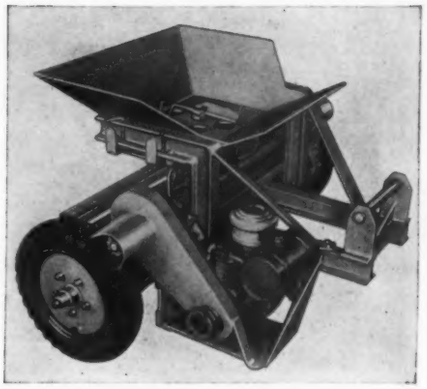
Features include: Single center gear ring and roller tracks, drum rollers turning on dustproof ball bearings, enclosed gear reduction, multiple "V" belt drive, outside band clutch and skip brake, oversize streamline skip equipped with automatic skip vibrator, accurate syphon-type water tank, auto type steering, spring mounted axles, anti-friction bearings throughout.

Research Products Now Make Birm

The Research Products Corporation, Madison, Wisconsin, has taken over the Water Treating Division of the C. F. Burgess Laboratories, Inc. The new company will continue with the same personnel, plant and equipment, and will manufacture zeolite for softening water, Birm for removing iron from water supplies, and Alkalex, a hydrogen exchanger, for removing alkalinity from water; also filtering materials. The officers of the Research Products Corporation are: Howard F. Weiss, President, Kemper Slidell, Vice President; Milton J. Shoemaker, Secretary; Max H. Kliefoth, Treasurer.

New ¾ Yard General Excavators

A new "General" excavator in the ¾ yard class—the 41—has been announced by The General Excavator Company of Marion, Ohio. To summarize from the manufacturers announcement: high speed and mobility—two travel speeds—chain crowd—boom adjustable to all angles—retract motion—ball and roller bearings—alloy steels—streamlined, all-weather cab-handy controls—further data on request.



New Warco Spreader

Warco Variable Speed Dual-Purpose Spreader

The W. A. Riddell Corporation of Bucyrus, Ohio, announces a new, variable-speed, dual-purpose spreader. The new spreaders, which will be known as the Warco-Hartley spreaders, are built in three types. The Model H is the regular type. The Model M is the transmission type and affords eight different speeds up to 35 miles per hour. The third is the Model M Transmission type, equipped with an independent motor (as shown in accompanying illustration), for driving the disc in spreading exceptionally heavy material such as black top chips.

These spreaders have a number of distinctive features, in that the width and thickness of the spread can be controlled accurately by the amount, speed and position with which the material is fed to the disc, which insures an even distribution of the material from 6 to 30 feet, depending upon the character of the material being spread.

The spreader is designed for use behind a truck traveling on the right side of the road, and discharges material behind and to the left of the truck. Discharge is arranged low enough so as not to interfere with passing traffic. An automatic hitch makes possible quick change from one truck to another.

This spreader will handle quickly sand, cinders, chloride or salt for ice control and it is also excellent for spreading chloride or other dust-laying materials in summer; birdseye stone or black top chips; and lime or fertilizer.

New General ¾-yard Excavator

Readers' Service Department

Help Yourself to These Helpful Booklets

These booklets are FREE. Use the coupon or write the manufacturer direct, mentioning PUBLIC WORKS.

Construction Materials and Equipment

Air Compressor from Ford Parts

5. How you can convert an ordinary Ford model A or B motor into an air compressor for operating jackhammers, paving breakers, clay spaders, tampers, paint sprays, etc., is explained in a new bulletin just issued by Gordon Smith & Co., Desk G, 516—10th St., Bowling Green, Ky.

Concrete

26. "Watertight Concrete." Detail information on how to make concrete that will not leak. Pictures show step by step procedure, and charts and diagrams give proper mixes and water-cement ratios for the work. 12 pp., ill., Lone Star Cement Corp., 342 Madison Ave., N. Y.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully subject suggested by title.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Solvay Sales Corp., 40 Rector St., N. Y. C.

36. "Wyandotte Calcium Chloride and its use in Portland Cement Concrete," a booklet covering the subject of curing concrete pavements, structures, etc., giving complete specifications for surface and integral curing. Published by the Michigan Alkali Co., 60 East 42d St., New York, N. Y.

Concrete Mixers

44. Catalog and prices of Concrete Mixers, both Tilting and Non-Tilt types, from 3½S to 56S sizes, The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

Culverts

60. "In diameters up to 10 feet and larger . . ." just issued by the Armco Culvert Mfrs. Assn., tells a good deal about drainage problems and their solution. 32 pages about drainage and multi-plate culverts.

Dirt Moving

65. "Dirt Moving," is a new 32 page booklet illustrating the use of Trac Tractors as a source of money-making power for bulldozers, bullgraders, wheel scrapers, fresnos, graders, dump wagons, tampers, etc. 24 pages of action pictures, directions, etc. Sent promptly by International Harvester Co., 180 No. Michigan Ave., Chicago, Ill.

Distributors

71. A handsome 14 page catalog, well illustrated in colors, tells how the 3 big features of the Littleford "Model C" pressure distributor work and why this machine is called, "everything you have ever wanted in a distributor." Your copy will be sent on request. Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service. The Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Loaders and Unloaders

97. Portable Loaders and Unloaders. Folders: Nos. 1414 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076, Portable Bucket elevators for different classes of work; and No. 1256, the "Grizzly" Crawler Loader for heavy work and large capacities. Link-Belt Company, 2045 W. Hunting Park Ave., Philadelphia, Pa.

Dirt Moving Efficency:

100. Where loading is done by hand, the Load Lugger, with your small truck, will cut costs tremendously. Simple, low in price. Especially adapted to city, county and town work. Complete details on request. Brooks Equipment & Mfg. Co., 56 Davenport Road, Knoxville, Tenn.

Motor Trucks

105. "What is Quality in a Motor Truck," is a new booklet containing valuable information for the prospective buyer of motor trucks. While this booklet refers especially to 1½ to 2-ton trucks, many of the facts contained in it are also applicable to heavy-duty units. Sent free on request by International Harvester Co., 180 North Michigan Ave., Chicago, Ill.

Mud-Jack Method

107. How the Mud-Jack Method for raising concrete curb, gutter, walls and streets solves problems of that kind quickly and economically without the usual cost and time-consuming reconstruction activities—a new bulletin by Koehring Company, 3026 West Concordia Ave., Milwaukee, Wis.

Paving Materials, Bituminous

110. Tarmac Handbook. Complete pocket-sized manual of construction and maintenance for surface treatment, road-mix plant-mix, etc. Koppers Co., Koppers Bldg., Pittsburgh, Pa.

112. Highway Engineers Asphalt Pocket Reference. This 236-page booklet, prepared by the Asphalt Institute, covers all phases of design and construction of asphalt highways and streets, describes paving equipment, gives specifications and describes methods of testing. A complete text on the subject sent on request by the Asphalt Institute, 801 Second Avenue, N. Y.

Paving Materials, Brick

116. Recommended standard specifications for vitrified brick pavements and brick parking strips and gutters, as submitted to the American Society of Municipal Engineers. If you contemplate using brick for paving, you should have a set. National Paving Brick Ass'n, Washington, D. C.

Paving Materials, Gutters

119. "Brick Gutters and Parking Strips." A study dealing with the problems faced in the proper construction of gutters and how they can be overcome. Covers design, construction and results. Well illustrated. Just issued by the National Paving Brick Ass'n, National Press Building, Washington, D. C.

Piling, Steel Sheet

120. All about steel sheet piling for sewage disposal plants, bridges, dams, levees, bulkheads, etc.—a light, strong, watertight, easy-to-handle substitute for wood sheeting. New catalog just issued by Corrugated Steel Sheet Piling Corp., Builders Building, Chicago, Ill.

Pumps

121. New illustrated catalog and prices of Jaeger Sure Prime Pumps, 2" to 10" sizes, 7000 to 220,000 G.P.H. capacities, also Jetting, Caisson, Road Pumps, recently issued by The Jaeger Machine Company, 400 Dublin Ave., Columbus, Ohio.

123. A new, 52 lb., midget, self-priming centrifugal pump which can be carried easily from job to job is described and illustrated in literature recently issued by Gorman-Rupp Co., Mansfield, Ohio.

Road Building and Maintenance

126. Action pictures show steps in road construction and maintenance, covering grading and ditching, rough grading, gravel and stone road construction, bituminous surfacing, fine grading and paving, summer and winter maintenance, municipal work and material handling, and illustrate Austin-Western equipment on such work. Ask for publication AD1655 Austin-Weston Road Machinery Co., Aurora, Ill.

Rock Breakers

129. How the Atlantic *Pneumatic* Rock Breaker splits large rocks and boulders quickly without explosives, plugs and feathers or other slow and costly methods is explained in a new illustrated circular issued by Atlantic Steel Co., 1775 Broadway, New York, N. Y.

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CONTINUED FROM PAGE 64

Pipe Joints, Sewer

415. How to make a perfect sewer pipe joint—tight, prevents roots entering sewer, keeps lengths perfectly aligned; can be laid with water in trench or pipe. General instructions issued by L. A. Weston, Adams, Mass.

416. Stop Root rings are used with clay or concrete pipe, without special tools, to make perfect joints that prevent roots entering sewer. Joints are made in usual way. A-B-C Mfg. Co., 227 So. 4th St., Quincy, Ill.

Taste and Odor Control

417. How, when, and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Div., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumps and Well Water Systems

420. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps, fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for these three descriptive booklets. Layne & Bowler, Inc., Dept. W, General Office Memphis, Tenn.

Pumping Engines

424. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Root-Proofing

425. Free sample of "Stop Root Ring" for root-proofing clay or concrete pipe without tools, and complete descriptive matter will be sent on request to A-B-C Mfg. Co., 227 So. 4th St., Quincy, Ill.

Run-off and Stream-Flow

426. Excellent booklet describes and illustrates the latest types of instruments for measuring run-off, both from small areas for storm sewer design, and from large areas for determining water shed yield. Sent promptly by Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

428. Be assured of uninterrupted, constant automatic removal of screenings. Folder 1587 tells how. Gives some of the outstanding advantages of "Straight-line Bar Screens" (Vertical and Inclined types). Link-Belt Co., 307 N. Michigan Avenue, Chicago, Ill.

Setting and Testing Equipment for Water Meters

430. All about setting and testing equipment for Water Meters—a beautifully printed and illustrated 40 page booklet giving full details concerning Ford setting and testing apparatus for all climates. Ford Meter Box Co., Wabash, Ind.

Rainfall Measurement

432. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

435. Water Screen Book No. 1252, describes traveling water intake screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sewage Filters, Magnetite

436. Well illustrated booklet describes the magnetite filter, and tells how it is used in the treatment of Sewage. Copy on request from Filtration Equipment Corp., 10 East 40th St., New York, N. Y.

Small Septic Tanks

438. Septic Disposal Systems, Waterless Toilets, Multiple Toilets for Camps and Resorts, and other products for providing safer sewage disposal for unsewered areas are described and illustrated in data sheets issued by San-Equip, Inc., 700 Brighton Ave., Syracuse, N. Y.

Sludge Drying and Incineration

439. The five basic steps of: sludge preparation; flash drying; incineration; deodorization; and dust collection are explained in a new 24 page booklet, No. 6781 issued by The Dorr Company, 570 Lexington Ave., New York, N. Y.

Sludge Incineration

440. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Swimming Pool Equipment

444. A new booklet "Essential Factors in the Design and Layout of Swimming Pool Systems," with data on filtration equipment, fittings, solution feeders, accessories, etc., is available from Everson Manufacturing Co., 213 West Huron St., Chicago, Ill.

445. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices plans, etc., write Roberts Filter Mfg. Co. 640 Columbia Ave., Darby, Pa.

446. 40-page Manual on swimming pools. Includes swimming pool layouts, specifications, etc., and details concerning Permutit Swimming Pool Equipment. Write The Permutit Co., Dept. G-4, 330 West 42 St., New York, N. Y.

Treatment

450. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

453. New booklet on Link-Belt Circuline Collectors for Settling Tanks contains excellent pictures and drawings of installations, sanitary engineering data and design details. Link-Belt Company, 307 North Michigan Ave., Chicago, Ill.

Water & Sewage Treatment Chemicals

500. Aluminum sulphate and ferric chloride for sewage coagulation, and these chemicals and ammonia, copper sulphate and others for water treatment. Information on uses and methods sent on request to General Chemical Co., 40 Rector St., New York, N. Y.

501. "Ferrisul for water and sewage treatment." What it is; what it will do for you and how to use it—a handy booklet issued by Merrimac Chemical Co., Everett Station, Boston, Mass.

Valve Box Tops

475. "Cut the Cost, but Not the Pavement," is the theme of a new bulletin on Rite-Hite Valve Box Tops. Gives directions for forming new tops on valve boxes, quickly and inexpensively without digging up the old box. Just issued by Trohn's Supplies, Inc., 205 Hoyt Ave., Mamaroneck, N. Y.

Water Works Operating Practices

490. "What Is New In Coagulation" is an excellent, new review with bibliography and outlines of latest work done in the field. Written by Burton W. Graham and sent free on request to Activated Alum Corp., Curtis Bay, Baltimore, Md.

Index to ADVERTISEMENTS

For the Engineer's Library

Brief reviews of the latest books, booklets and catalogs for the public works engineer.

Better Road Bases:

"Better Bases for Better Roads" is an endeavor to answer some of the questions regarding specially designed and constructed bases—What are their advantages? What is the best type of base? What do they cost? Is the expense justified? Have such bases proved successful? Covers density, uniformity, durability, flexibility and low cost. 14 pp., illustrated. Sent on request. Solvay Sales Corp., 40 Rector Street, N. Y.

Fresh Water Animal Life:

A text-book by H. Mellanby, B.Sc., Ph.D., of Sheffield University. 287 pp. profusely illustrated. Covers life in fresh water, sponges, hydroids, flatworms, roundworms, true worms, arthropoda, crustacea, insects, arachnids, mollusca, polyzoa wheel animalcules, and protozoa. $3.50.

Compressed Air:

Trade Standards of the Compressed Air Institute is a 112-page text, 8½ x 11, with wire binding. Includes definitions, rating standards, installation and care of compressors, lubrication, data, tables, formulas, and full descriptions of the various types of compressors and accessories. $1. Compressed Air Institute, 90 West Street, New York, N. Y.

Pipe Coatings:

Includes "suggested specifications for lining cast iron pipe over coal tar dips without using primer." This text supplements a previous booklet—"Water Works Protection"—and with it keeps information at hand up to date. Barrett Co., 40 Rector Street, N. Y.

Davey "Air Log":

This 60-page booklet does more than describe the complete line of Davey Air Compressors. Every construction detail is illustrated. New equipment—models 105 and 315—are described. "Auto-Air" units (truck-mounted) are shown; also the pneumatic saw and (shades of Abraham Lincoln) the pneumatic log splitter. Includes 100 photographic illustrations. Write Arthur C. Palm, Davey Compressor Co., Kent, Ohio.

Brick Pavements:

Specifications for constructing bituminous filled brick pavements, as adopted June 30, 1938, by the American Association of State Highway Officials, have been republished as a 9-page pamphlet for the convenience of engineers and contractors, and will be sent on request to the National Paving Brick Association, National Press Building, Washington, D. C.

Street Cleaning Practice:

There hasn't been an adequate text on street cleaning practice for many years. This book is a product of the Street Cleaning Committee of the American Public Works Association, Chicago, Ill. It contains 407 pages and sells for $4. After a discussion of local conditions as they affect street cleaning, there is a discussion of selection of method, frequency, time of cleaning, routing and establishment of schedules. Other sections cover reducing amount of street litter, cleaning catch basins, snow removal, ice control, and other factors. The final portion deals with administration, including organization, personnel, management of equipment, records, costs and budgets.

Sludge Bed Covers:

Glass covers for sludge beds and also for trickling filters and other units are described and illustrated in this 24-page booklet; cross sections, details, elevations and dimensions; specifications. Ask for Catalog GE31, American-Moninger Greenhouse Mfg. Co., Brooklyn, N. Y.

Metal Piles:

A new 20-page catalog on Fluted Monotube Piles has been issued by The Union Metal Manufacturing Company, Canton, Ohio. In addition to describing the product and method of installation, this catalog contains complete engineering data as well as illustrations of unusual and interesting piling jobs. Booklet 68 will be sent on request.

Safer Winter Travel:

A 20-page booklet contains much valuable information on how to make icy pavements safe with rock salt. Covers use in ice *prevention,* use with abrasives, how to treat cinder and sand with salt, amount of salt required, how to apply treated abrasives, and where to apply. There are 18 "facts about the use of rock salt for ice control." On request to International Salt Co., Inc., Scranton, Pa.

Sanitation in Pictures:

"Dorr Sanitary Installations Through the Camera's Eye" is a fine publication that shows views of 19 typical water and sewage treatment plants in which Dorr equipment is used. A brief summary of equipment and design is given for each plant. Dorr Co., Inc., 570 Lexington Ave., New York, N, Y.